MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

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IQAC

MUST KNOW CONCEPTS | MKC

BME & MDE | **2021-22**

Course Code & Course Name : 16MDE04 – BIO MEDICAL ENGINEERING

Year/Sem : IV / VII

S.No.	Term	Notation (Symbol)	Concept / Definition / Meaning / Units / Equation / Expression	Units
Unit-I : Physiology and Transducers				
1.	Cell	-	A cell consists of three parts: the cell membrane, the nucleus, and, between the two, the cytoplasm. Within the cytoplasm lie intricate arrangements of fine fibers and hundreds or even thousands of miniscule but distinct structures called organelles.	-
2.	Resting potential	-	The relatively static membrane potential of quiescent cells is called the resting membrane potential,	-
3.	Action potential	-	An action potential occurs when the membrane potential of a specific cell location rapidly rises and falls	-
4.	Nervous system	-	The nervous system is a highly complex part of an animal that coordinates its actions and sensory information by transmitting signals to and from different parts of its body.	-
5.	Neurons	-	Neurons (also called neurons or nerve cells) are the fundamental units of the brain and nervous system, the cells responsible for receiving sensory input from the external world, for sending motor commands to our muscles, and for transforming and relaying the electrical signals at every step in between.	-
6.	Neuronal communication	-	Neuronal communication is made possible by the neuron's specialized structures, like the soma, dendrites, axons, terminal buttons, and synaptic vesicles.	-
7.	Cardiovascular System	-	It consists of the heart, which is a muscular pumping device, and a closed system of	-

			vessels called arteries, veins, and capillaries.	
8.	Respiratory System	-	The human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon dioxide. The primary organs of the respiratory system are the lungs, which carry out this exchange of gases as we breathe.	-
9.	Transducer	-	A transducer is a device that converts energy from one form to another.	-
10.	Piezo- Electric Transducer.	-	The Piezoelectric transducer is an electro acoustic transducer use for conversion of pressure or mechanical stress into an alternating electrical force.	-
11.	Prokaryotic	-	The organisms whose cells lack a nuclear membrane	-
12.	Eukaryotic	-	The organisms whose cells have a nuclear membrane	-
13.	Plasma membrane	-	Every cell is bound by a thin delicate membrane	-
14.	Endoplasmic reticulum	-	A continuous membrane system that forms a series of flattened sacs within the cytoplasm of eukaryotic cells and serves multiple functions, being important particularly in the synthesis, folding, modification, and transport of proteins .	-
15.	Golgi Apparatus	-	It packages proteins into membrane-bound vesicles inside the cell before the vesicles are sent to their destination.	-
16.	Ribosomes	-	Ribosomes are minute particles consisting of RNA and associated proteins that function to synthesize proteins	-
17.	Lysosomes	-	A lysosome is a membrane-bound cell organelle that contains digestive enzymes. They break down excess or worn-out cell parts. They may be used to destroy invading viruses and bacteria.	-
18.	Mitochondria	-	Mitochondria are membrane-bound cell organelles that generate most of the chemical energy needed to power the cell's biochemical reactions.	-
19.	Half cell potential	-	The half-cell potential is the potential developed at the electrode of a half cell due to the process of oxidation or reduction.	-
20.	Hyperpolarization	-	Hyperpolarization is when the membrane potential becomes more negative at a particular spot on the neuron's membrane,	-

21.	Depolarization	-	depolarization is when the membrane potential becomes less negative (more positive)	-
22.	Synapse	-	A synapse is a structure that permits a neuron (or nerve cell) to pass an electrical or chemical signal to another neuron or to the target effector cell.	-
23.	Sensor	-	A sensor is a device that measures physical input from its environment and converts it into data that can be interpreted by either a human or a machine.	-
24.	Neurotransmitter	-	Neurotransmitters are chemical messengers that transmit a message from a nerve cell across the synapse to a target cell.	-
25.	Dendrites	-	Dendrites also dendrons, are branched protoplasmic extensions of a nerve cell that propagate the electrochemical stimulation received from other neural cells to the cell body	-
Unit-II : Electro – Physiological Measurements				
26.	Electrode	-	An electrode is a solid electric conductor that carries electric current into non-metallic solids, or liquids, or gases, or plasmas, or vacuums. Electrodes are typically good electric conductors, but they need not be metals.	-
27.	Limb Electrode	-	The lead connected to the right ankle is a neutral lead, like you would find in an electric plug. It is there to complete an electrical circuit and plays no role in the ECG itself.	-
28.	Microelectrode	-	A microelectrode is an electrode used in electrophysiology either for recording neural signals or for the electrical stimulation of nervous tissue	-
29.	Needle electrode	-	A fine wire through which electrical current may flow when attached to a power source; used to carry high frequency electrical currents that create heat or destroy diseased tissue	-
30.	Surface Electrode	-	A small device that is attached to the skin to measure or cause electrical activity in the tissue under it. .	-
31.	Preamplifier	-	A preamplifier is an electronic amplifier that converts a weak electrical signal into an output signal strong enough to be noise-tolerant	-

32.	Differential Amplifier	-	A differential amplifier is a type of electronic amplifier that -9*/8amplifies the difference between two input voltages but suppresses any voltage common to the two inputs.	-
33.	Chopper amplifier	-	The name Chop means to sample the data. The amplifier circuit samples the analog signal.	-
34.	Isolation amplifiers	-	Isolation amplifiers are a form of differential amplifier that allow measurement of small signals in the presence of a high common mode voltage by providing electrical isolation and an electrical safety barrier.	-
35.	ECG	-	An electrocardiogram (ECG) is a test which measures the electrical activity of our heart.	-
36.	EEG	-	An electroencephalogram (EEG) is a test used to find problems related to electrical activity of the brain. An EEG tracks and records brain wave patterns.	-
37.	EMG	-	Electromyography (EMG) is an electrodiagnostic medicine technique for evaluating and recording the electrical activity produced by skeletal muscles.	-
38.	ERG	-	The Electroretinogram (ERG) is a diagnostic test that measures the electrical activity generated by neural and non-neuronal cells in the retina in response to a light stimulus.	-
39.	Leakage current	-	Leakage current is the current that flows from either AC or DC circuit in equipment to the chassis, or to the ground, and can be either from the input or the output.	-
40.	shock hazard	-	A shock hazard occurs when electric current passes through a person. Shocks range in severity from painful, but otherwise harmless, to heart-stopping lethality.	-
41.	Thermal hazard	-	A thermal hazard is one where excessive electric power causes undesired thermal effects, such as starting a fire in the wall of a house.	-
42.	Einthoven's triangle	-	Einthoven's triangle is an imaginary formation of three limb leads in a triangle used in electrocardiography, formed by the two shoulders and the pubis.	-
43.	Electrooculogram.	-	The EOG measures the electrical difference that exists between the cornea and the retina this is the resting or standard	-

			potential of the eye.	
44.	Motor Nerve	-	A motor nerve is a nerve located in the central nervous system (CNS), usually the spinal cord, that sends motor signals from the CNS to the muscles of the body.	-
45.	Montage	-	electrode pairs, with waveforms representing the potential difference between the two electrodes	-
46.	Active Electrode	-	An active electrode is an electrode that can be oxidized or reduced in half reaction	-
47.	Reference Electrode	-	A reference electrode is an electrode which has a stable and well-known electrode potential.	-
48.	Ground Electrode	-	A conductor buried in the ground, used to maintain conductors connected to it at ground potential and dissipate current conducted to it into the earth,	-
49.	Pregelled disposable electrodes	-	The disposable medical electrode includes a disk formed of a semi-rigid plastic material having a recessed embossment located centrally thereof	-
50.	SA & AV node	-	The SA node (called the pacemaker of the heart) sends out an electrical impulse. The upper heart chambers (atria) contract. The AV node sends an impulse into the ventricles.	-
Unit-III : Non-Electrical Parameter Measurements				
51.	Cardiac output	-	Cardiac output, also denoted by the symbols, or, is a term used in cardiac physiology that describes the volume of blood being pumped by the heart, in particular by the left or right ventricle, per unit time.	-
52.	systolic pressure	-	The maximum pressure reached during cardiac ejection is called systolic pressure	-
53.	diastolic pressure.	-	The minimum pressure occurring at the end of a ventricular relaxation is termed as diastolic pressure.	-
54.	Types of blood pressure measurement	-	1.Direct Methods of Monitoring Blood Pressure 2.Indirect Methods of Blood Pressure Measurement	-
55.	Cannulation Techniques	-	Central venous pressure (CVP) measurements made with needle	-

			cannulation techniques	
56.	Types of Cardiac measurement	-	Indicator dilution method Dye dilution method Thermal dilution techniques	-
57.	Cardiac output Formula	-	$\text{Cardiac output} = \frac{(1.08)\,(C)\,(60)\,(V)\,(T_i - T_b)}{\int \Delta T\, dt}$	-
58.	Apnoea	-	Apnoea may also occur in premature babies	-
59.	Spirometer	-	The instrument used to measure lung capacity and volume is called a spirometer.	-
60.	Blood gas analyzers	-	Blood gas analyzers are used to measure the Blood pH, partial pressure of carbon dioxide (pCO_2) and partial pressure of oxygen (pO_2) of the body fluids	-
61.	The normal pH value	-	The normal pH of the extracellular fluid lies in the range of 7.35-7.45.	-
62.	ESR	-	The erythrocyte sedimentation rate is the rate at which red blood cells in anti coagulated whole blood descend in a standardized tube over a period of one hour. It is a common hematology test, and is a non-specific measure of inflammation.	-
63.	Photo Plethys mography	-	A photoplethysmogram is an optically obtained plethysmogram that can be used to detect blood volume changes in the microvascular bed of tissue.	-
64.	Body plethys mography	-	Body plethysmography provides measures of the lung that reflect a multitude of functional and structural aspects.	-
65.	Heart rate	-	Heart rate, also known as pulse, is the number of times a person's heart beats per minute.	-
66.	Blood pressure	-	Blood pressure is measured in millimeters of mercury (mm Hg) and recorded with the systolic number first, followed by the diastolic number.	-
67.	pCO2	-	$pCO_2 = \text{Barometric pressure} - \text{water vapour pressure} \times \frac{\%\,CO_2}{100}$	-
68.	Pulse oximetry	-	Pulse oximetry is a noninvasive method for monitoring a person's oxygen saturation.	-

69.	Oximetry	-	Oximetry refers to the determination of the percentage of oxygen saturation of the circulatingarterial blood.	-
70.	Oxygen Saturation	-	$\text{Oxygen saturation} = \frac{[HbO_2]}{[HbO_2]+[Hb]}$	-
71.	GSR	-	The Galvanic Skin Response (GSR), also named Electrodermal Activity (EDA) and Skin Conductance (SC), is the measure of the continuous variations in the electrical characteristics of the skin.	-
72.	The BSR output	-	The BSR (basal skin response)output is connected to an RC network with a time constant of 3 to 5 secondswhich enables the measurement of GSR as a change of the skin resistance.	-
73.	Pulmonary function analyzers	-	Pulmonary function analyzers provide the means for automated clinical procedures andanalysis techniques for carrying out a complete evaluation of the lung function	-
74.	Tidal Volume (TV)	-	The volume of gas inspired or expired (exchanged with each breath) duringnormal quiet breathing, is known as tidal volume.	-
75.	Residual Volume (RV)	-	The volume of gas remaining in the lungs after a forced expiration	-
Unit-IV : Medical Imaging and Biotelemetry				
76.	Radiography	-	Radiography provides essential information on anatomical structures and abnormalities while thermography indicates metabolic process .	-
77.	Photographic film	-	An image produced by radiation, usually by x-rays, and recorded on a radiosensitive surface, such as photographic film, or by photographing a fluoroscopic image.	-
78.	Radio graphic techniques	-	Minimising radiation dose in computed tomography of kidneys, ureters and bladder Quality of chest x-rays.	-
79.	Fluoroscopic techniques	-	Fluoroscopy is a type of medical imaging that shows a continuous X-ray image on a monitor, much like an X-ray movie. During a fluoroscopy procedure, an X-ray beam is passed through the body	-
80.	Digital X-ray Imaging System	-	X-ray imaging transducer or data collection Data display, storage and processing.	-
81.	Digital image transducer Types	-	Image intensifier TV system Radiographic (film replacement) systems.	-
82.	Computer tomography	-	Computed tomography (CT) is an imaging procedure that uses special x-ray equipment to	-

			create detailed pictures, or scans, of areas inside the body.	
83.	Computerized Axial Tomography	-	It is also called computerized tomography and computerized axial tomography	-
84.	Angiography	-	Visualization of vessels is called Angiography	-
85.	Image Intensifier	-	The image intensifier is a complex electronic device that receives the remnant X-Ray beam, converts it into light, and increases the light intensity.	-
86.	Photo emission	-	The photocathode is a thin metal layer, usually composed of cesium and antimony compounds, that respond to stimulation by light with the emission of electron. This process is known as photo emission.	-
87.	Image monitoring Types	-	Thermionic television camera tube The solid state charge-coupled device (CCD).	-
88.	CT Systems Components	-	Scanning system Processing unit Viewing part Storage unit	-
89.	Magnetic resonance imaging	-	Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to form pictures of the anatomy and the physiological processes of the body.	-
90.	MRI scanners	-	MRI scanners use strong magnetic fields, magnetic field gradients, and radio waves to generate images of the organs in the body.	-
91.	Ultrasonography	-	Medical ultrasound (also known as diagnostic sonography or ultrasonography) is a diagnostic imaging technique based on the application of ultrasound.	-
92.	Ultrasonograp-hy Uses	-	It is used to create an image of internal body structures such as tendons, muscles, joints, blood vessels, and internal organs.	-
93.	Endoscopy	-	Endoscopy is a nonsurgical procedure used to examine a person's digestive tract.	-
94.	Advantages of Optical Fibre Sensors	-	Immune from cross-talk.	-
95.	Types of Optical Fibre Sensors	-	Photometric sensors Physical sensors Chemical sensors	-
96.	Medical Thermograph	-	The medical thermograph is a sensitive infrared camera which presents a video image of the temperature distribution over the surface of the skin.	-
97.	Units of Thermograph	-	A special infrared camera that scans the object, and a display unit for displaying the thermal picture on the screen.	-
98.	Different types of biotelemetry systems	-	There are two types of biotelemetry units: single-channel and multichannel.	-

99.	Telemetry	-	Telemetry is the collection of measurements or other data at remote or inaccessible points and their automatic transmission to receiving equipment for monitoring.	-
100.	Essential components of a wireless system	-	– Telemetry Hub for Consolidating, Storing and Uploading data. –Wireless Survey Kit –software	-
Unit-V : ASSISTING AND THERAPEUTIC EQUIPMENTS				
101.	Pacemaker	-	Small device that's placed under the skin in your chest to help control your heartbeat.	-
102.	Types of pacemakers	-	Single chamber pacemaker. Dual chamber pacemaker. Biventricular pacemaker.	-
103.	Single chamber pacemaker.	-	This type usually carries electrical impulses to the right ventricle of your heart	-
104.	Dual chamber pacemaker.	-	This type carries electrical impulses to the right ventricle and the right atrium of your heart to help control the timing of contractions between the two chambers.	-
105.	Biventricular pacemaker.	-	Biventricular pacing, also called cardiac resynchronization therapy, is for people with heart failure with abnormal electrical systems.	-
106.	A pacemaker comprises two parts:	-	Pulse generator. This small metal container houses a battery and the electrical circuitry that regulates the rate of electrical pulses sent to your heart. Leads (electrodes). One to three flexible, insulated wires are each placed in a chamber, or chambers, of your heart and deliver the electrical pulses to adjust your heart rate.	-
107.	Risks of pacemaker	-	Infection where the pacemaker was implanted Allergic reaction to the dye or anesthesia used during your procedure Swelling, bruising or bleeding at the generator site, especially if you take blood thinners Damage to your blood vessels or nerves near the pacemaker Collapsed lung	-
108.	Test taking before pacemaker	-	Electrocardiogram (ECG). Holter monitoring. Echocardiogram. Stress test.	-
109.	Internal	-	Consists of myocardial or endocardial	-

	pacemaker		electrodes. It is intended for long-term use. This kind of pacemaker is also called implantable pacemaker.	
110.	External pacemaker	-	This pacemaker is usually transistorized, miniaturized, battery-powered and patient-portable. It is recommended for short-term or temporary use.	-
111.	Defibrillators	-	Devices that restore a normal heartbeat by sending an electric pulse or shock to the heart.	-
112.	Types of defibrillators	-	1. AC defibrillators 2. DC defibrillators	-
113.	DC defibrillator	-	DC defibrillator does not produce side effects and produces normal heartbeat. Ventricular fibrillation is avoided when high-energy shock is passed through discharging capacitor that is exposed to heart or chest of the patient.	-
114.	AC Defibrillators	-	An AC defibrillator is the oldest and simplest type. The construction of AC defibrillator is such that appropriate values are available for internal and external defibrillation.	-
115.	Implantable Cardioverter Defibrillator (ICD)	-	ICDs are useful in preventing sudden death in patients with known, sustained ventricular tachycardia or fibrillation.	-
116.	ICD Measures	-	• Acute myocardial infarction (heart attack) • Myocardial ischemia (inadequate blood flow to the heart muscle) • Electrolyte imbalance and drug toxicity	-
117.	Ventilator	-	If a condition makes it very difficult for you to breathe or get enough oxygen into your blood. This condition is called respiratory failure	-
118.	Nerve Stimulation	-	Nerve stimulation is a technique that aims to relieve pain using an electrical current. Transcutaneous Electrical Nerve Stimulation (or TENS) involves sending small, low-voltage electrical impulses to a specific nerve via electrodes placed on the skin,	-
119.	Muscle Stimulation	-	Electrical stimulation is a technique that aims to stimulate the muscles using an electrical current in order to achieve a	-

			specific result. Electrical Muscle Stimulation (EMS) involves delivering small, low-voltage electrical impulses to a muscle via electrodes placed on the skin, in order to cause the muscle to contract.	
120.	TENS machines work		1.They block the transmission of pain signals to the brain. 2.They stimulate the production of endorphins (which are natural painkillers). 3.They improve blood circulation. .	
121.	EMS machine works	-	1.Relax the muscle 2.Minimise any inflammation 3.Prevent muscle atrophy 4.Speed up muscle healing 5.Stimulate muscle growth	-
122.	Heart lung machine	-	Cardiopulmonary bypass (CPB) is a technique that temporarily takes over the function of the heart and lungs during surgery, maintaining the circulation of blood and the oxygen content of the body. The CPB pump itself is often referred to as a heart–lung machine	-
123.	Audiometer	-	Machine used for evaluating hearing acuity.	-
124.	*Dialyzer*	-	often referred to as an "artificial kidney." Its function is to remove the excess wastes and fluid from the blood, when the patient's kidneys can no longer perform that task.	-
125.	Lithotripsy	-	Medical procedure used to treat certain types of kidney stones and stones in other organs, such as your gallbladder or liver.	-
Placement Questions				
126.	Types of disabilities	-	Hearing impaired Seeing impaired Learning and physically disabled	-
127.	Physical disabilities	-	Arthritis, amputation, brain and spinal injury and cerebral palsy.	-
128.	Sett framework	-	The SETT Framework is a tool that helps teams gather and organize information.	-
129.	Limits of technology	-	Natural, economic, and ethical.	-
130.	Disadvantages of assistive technology	-	the person switches off or unplugs the equipment. the person is confused or distressed by any alarm sounds or recorded messages.	-

131.	Instrumentation	-	Instrumentation is the use of measuring instruments to moniter and control a process.	-
132.	Bio medical Instrumentation (BMI)	-	Bio medical instrumentation is the field of creating such instruments that help us to measure, record and transmit data to or from the body.	-
133.	Clinical Instruments	-	It basically used in clinical fields. And it devoted to the areas like Diagnosis, Patient care, Treatment of patients(Therapeutic use) etc..	-
134.	Research Instrumentation	-	It is used primarily in the search for a new knowledge related to various systems that compose the human organsism.	-
135.	Vivo	-	• Measurement is made within the human body.	-
136.	Types of contraction	-	• Isometric-A muscular contraction in which the length of the muscle does not change. • Isotonic- A muscular contraction in which length of the muscle changes. • Eccentric-An isotonic contraction where the muscle lengthens. • Concentric-An isotonic contraction where the muscle shortens.	-
137.	Mobilization exercise	-	Mobilization is a manual therapeutic technique that fosters movement in stagnant tissue and joints.	-
138.	Examples of mobility exercise	-	• Ankle mobility • Walking hip openers • Thoracic spine windmills on floor	-
139.	Endurance exercise	-	It is the act of exercising to increase endurance. Endurance activity keeps your heart,lungs and circulatory system healthy and improves your overall fitness.	-
140.	Types of endurance	-	• Aerobic endurance • Anaerobic endurance • Anaerobic threshold • Speed endurance • Strength endurance.	-
141.	Application of mobility aids	-	• Arthritis • Fractures or broken bones • Gout • Obesity • Walking impairment due to stroke or brain injury • Visual impairment or blindness	-

142.	Assistive technology	-	Any technology that helps people with disability to performance a function or activity that they wouldn't be able to perform otherwise.	-
143.	Function of assistive device	-	Technology are those whose primary purpose is to maintain or improve an individual is functioning and independence of facilitate participation and to enhance overall well being	-
144.	Hearing for AD	-	• Hearing aids • Hearing loops	-
145.	Positioning for AD	-	• Cushions • Splints	-
146.	Therapeutic	-	The branch of medicine concerned with treatment of disease and action of remedical agent.	-
147.	Therapeutic equipment	-	Treatment equipments include infusion pumps,medical laser, LASIK surgical machines.life support equipment is used to maintain a patient bodily function.	-
148.	Basic medical equipments	-	➢ Hospital stretchers ➢ Patient monitors ➢ Sterilizers ➢ Surgical tables ➢ Blanket and fluid warmers.	-
149.	Uses of medical device	-	Medical devices benefit patients by health care providers diagnose and treat patient and helping patients overcome sickness or disease,improving their quality of life.	-
150.	List of therapeutic equipments	-	1. Cardiac pacemaker 2. Defibrillator 3. Ventilator	-
Faculty Prepared		**Dr. J. Alphas Jeba Singh** Associate Professor, Department of BME.		**Signature**

HoD