MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

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Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

Must Know Concepts (MKC)

BME

2021-2022

Subject		19BMC02 Biomedical Sensors & Instruments		
S. No.	**Term**	**Notation (Symbol)**	**Concept/Definition/Meaning/Units/Equation/ Expression**	**Units**
			UNIT –I	
1.	**Instrument**		An instrument is a device for determining the value or magnitude of a quantity.	
2.	**Standard**		A known accuracy measure of physical quantity is termed as standard.	
3.	**Calibration**		Calibration is the process of checking the accuracy of instrument	
4.	**Accuracy**		The degree of closeness of a measurement compared to the true value	
5.	**Measurement**		The process of determining the present value is called as measurement.	
6.	**Error**		Difference between indicated value and true value of the quantity	
7.	**Tolerance**		Maximum allowable error in the measurement of some value	
8.	**Range or span**		The minimum and maximum values of a quantity in instrument	
9.	**Lag**		System takes some time	
10.	**Limiting error**		Accuracy * full scale value	
11.	**Static error**		Numerical difference between the true value of a quantity and its value obtained by measurement	
12.	**Need for measurement**		To know about the unknown magnitude	
13.	**Repeatability**		Variation of scale reading and it is random in nature	
14.	**Median**		Middle value of a set of an odd number of readings,if variables are arranged in numerical order.	
15.	**Transducer**		A device that converts variations in a physical quantity into electrical signal	
16.	**Variance**		variance is the expectation of the squared deviation of a random variable from its mean	
17.	**Characteristic of tranducer**		• Sensitivity. • Linearity. • Resolution.	

			• Precision (Accuracy) • Span and Range.	
18.	**Linearity**		Linearity is closely related to proportionality.	
19.	**Resolution.**		Resolution measures the number of pixels in a digital image or display.	
20.	**Types of Transducer**		• Temperature transducers • Pressure transducers • Displacement transducers • Oscillator transducer.	
21.	**Temperature transducers**		Is a device that converts the thermal quantity into any physical quantity such as mechanical energy, pressure and electrical signals	
22.	**Pressure transducers**		Is a measuring device which converts an applied pressure into an electrical signal.	
23.	**Oscillator transducer.**		Is a type of transducer that can be used to measure force, pressure, or displacement by converting it a voltage	
24.	**Instrument**		Device used for measuring the value or magnitude of a quantity or variable	
25.	**Transducer**		It is a device which converts energy from one form to another form	
UNIT –II				
26.	**Strain gauge**		A strain gauge is a sensor whose resistance varies with applied force	
27.	**Displacement**		A displacement is a vector whose length is the shortest distance from the initial to the final position of a point P undergoing motion	
28.	**Pressure**		Pressure is the force applied perpendicular to the surface of an object per unit area over which that force is distributed.	
29.	**Pressure transducers**		Is a measuring device which converts an applied pressure into an electrical signal.	
30.	**temperature sensor**		Measures the temperature of its environment and converts the input data into electronic data to record, monitor, or signal temperature changes.	
31.	**resistive transducer**		A resistive transducer is an electronic device that is capable of measuring various physical quantities like temperature, pressure, vibration, force	
32.	**Thermistor**		A thermistor is a thermally sensitive resistor that exhibits a precise and predictable change to resistance proportional to small changes to body temperature	
33.	**RTD**		Determine the temperature by measuring the resistance of pure electrical wire.This wire is reffered to as a temperature sensor.	
34.	**Temperature error**		When high currents are passed through the coil,self heating of coil occurs which producers error	
35.	**Gauge factor**		Gauge factor or strain factor of a strain gauge is the ratio of relative change in electrical resistance R, to the mechanical strain ε.	
36.	**Sensing element**		Any device that receives a signal or stimulus	
37.	**Biomedical applications of strain gauge**		Strain gauges are incorporated into instruments such as syringe pumps and kidney dialysis machines.	

38.	**Displacement Transducer**		A Displacement Transducer is an electromechanical device used to convert mechanical motion or vibrations.	
39.	**Types of displacement transducers**		Linear Potentiometer Capacitive sensor.	
40.	**RTD materials**		RTDs contain either platinum, nickel, or copper wires, as these materials have a positive temperature coefficient.	
41.	**Thermistor**		A thermistor is a type of resistor whose resistance varies with temperature; that is, thermistors show qualities similar to RTDs.	
42.	**Types of Thermistors:**		Positive-temperature coefficient Negative-temperature coefficient	
43.	**Thermistor Applications:**		We can use PTC thermistors as current-limiting devices for circuit protection, as replacements for fuses. Thermistors are also commonly used in modern digital thermostats and to monitor the temperature of battery packs while charging.	
44.	**Application of temperature sensor**		They can be used to detect solids, liquids or gases over a wide range of temperatures.	
45.	**Types of temperature sensors**		Thermocouples, RTDs (resistance temperature detectors), thermistors, and semiconductor based integrated circuits (IC).	
46.	**LVDT**		An LVDT is an electromechanical sensor used to convert mechanical motion or vibrations specifically rectilinear motion into a variable electrical current,voltage or electric signals	
47.	**Capacitive transducer**		An capacitive transducer is the capacitor with variable capacitance	
48.	**Advantages of Capacitive transducers**		Very good resolution Sensitive is very high	
49.	**Disadvantageof capacitive transducer**		Temperature sensitive Affected by stray capacitance	
50.	**Applications of capacitive transducer**		Used in pressure, displacement, force and level measurement.	
UNIT-III				
51.	**Piezoelectric effect**		The potential is applied to the proper axis of crystal,it will change the dimensions of crystal	
52.	**Piezoelectric transducer**		Piezoelectric transducer is an electro acoustic transducer use for conversion of pressure or mechanical stress into an alternating electrical force.	
53.	**Photo electric**		A photoelectric sensor, is an equipment used to discover the distance, absence, or presence of an object by using a light transmitter	
54.	**Scintillation**		A scintillation counter is an instrument for detecting and	

	counter		measuring ionizing radiation by using the excitation effect of incident radiation.	
55.	**Phototransistor**		A phototransistor is a device that converts light energy into electric energy	
56.	**Photo multiplier tube**		Amplifying the electrons generated by photocathode exposed to photon flux.	
57.	**Photovoltaic**		Photovoltaic is the conversion of light into electricity using semiconducting materials	
58.	**Photoconductive**		Photoconducting is an optical and electrical phenomenon in which a material becomes more electrically conductive due to the absorption of electromagnetic radiation	
59.	**Photodiode**		A photodiode is a semiconductor device that converts light into an electrical current	
60.	**Ammeter**		It is a current measuring device which measures current through circuit	
61.	**Voltmeter**		A voltage measuring device which means potential difference between the two points of a circuit	
62.	**Multimeter**		An instrument designed to measure device which electric current,voltage and usually resistance typically over several ranges of value	
63.	**Spectrometer**		A spectrometer is any instrument used to probe a property of light as a function of its portion of the electromagnetic spectrum, typically its wavelength, frequency, or energy.	
64.	**Spectrophotometry**		is a method to measure how much a chemical substance absorbs light by measuring the intensity of light as a beam of light passes through sample solution	
65.	**Applications of spectrophotometer**		• Detection of concentration of substances • Detection of impurities • Structure elucidation of organic compounds	
66.	**Filter**		Removes some unwanted components or features from a signal	
67.	**Applications of photoelectric effect**		Photoelectric effect also founds application in photocopies, light meter, photodiodes, phototransistors.	
68.	**Active transducer**		Which converts the non-electrical quantity into an electrical quantity.	
69.	**Active transducer applications**		Active transducer doesn't require any power source for their operations. These transducers work on the principle of energy conversion.	
70.	**Biomedical applications of pressure transducers**		• Pressure Sensors For Respirator and Breath Detection Equipment. ... • Pressure Sensors & Oxygen Sensors for O2 Concentrators & Conservers. ... • Pressure Sensors For Deep Vein Thrombosis. ... • Infusion Pumps. ... • Inflatable Mattresses.	
71.	**Ultrasonic transducers**		Ultrasonic transducers and ultrasonic sensors are devices that generate or sense ultrasound energy.	
72.	**ultrasound transducer biomedical applications**		Ultrasonic transducers have been widely used in biomedical applications for imaging, therapeutics, cell separation	
73.	**Photo multiplie**		These detectors work by amplifying the electrons generated by a photocathode exposed to a photon flux	

	r tube			
74.	**Uses of photomultipliers**		Photomultipliers are used to measure the intensity and spectrum of light-emitting materials such as compound semiconductors and quantum dots.	
75.	**Spectrophotometer**		A spectrophotometer is an instrument that measures the amount of light absorbed by a sample.	
			UNIT IV	
76.	**Alternating current**		Alternating current is an electric current which periodically reverses direction and changes its magnitude	
77.	**AC bridges**		AC bridges are the circuits that are used for the measurement of electrical quantities such as inductance, capacitance, resistance	
78.	**Direct current**		Direct current is the one directional or unidirectional flow electric charge	
79.	**DC bridge**		If the bridge circuit can be operated with only DC voltage signal, then it is a DC bridge circuit or simply DC bridge	
80.	**Wheatstone bridge**		A Wheatstone bridge is an electrical circuit used to measure an unknown electrical resistance by balancing two legs of a bridge circuit	
81.	**Kelvin bridge**		A Kelvin bridge, also called a Kelvin double bridge , is a measuring instrument used to measure unknown electrical resistors below 1 ohm.	
82.	**Maxwell bridge**		Used to measure an unknown inductance in terms of calibrated resistance and inductance or resistance and capacitance.	
83.	**Schering bridge**		is an electrical circuit used for measuring the insulating properties of electrical cables and equipment	
84.	**Uses of ac bridges**		Used to find unknown impedances along with associated parameters	
85.	**Uses of dc bridges**		Used to measure resistance	
86.	**Concepts of filter**		Filter is a device or process that removes some unwanted components or features from a signal.	
87.	**Preamplifier**		That converts a weak electrical signal into an output signal strong enough to be noise-tolerant	
88.	**Types of preamplifiers**		• current-sensitive preamplifier • parasitic-capacitance preamplifier • charge-sensitive preamplifier	
89.	**Preamp**		A preamp boosts a weaker signal to line level	
90.	**Impedance matching**		Impedance matching is defined as the process of designing the input impedance and output impedance of an electrical load to minimize the signal reflection	
91.	**Why is Impedance Matching Important**		Important in the case of the high speed and high-frequency devices.	
92.	**Impedance Matching Applications**		The main goal of a designer is to achieve maximum power that can deliver from the source to load.	

93.	**Isolation amplifier**		An isolation amplifier (also called a unity-gain amplifier) is an op-amp circuit which provides isolation of one part of a circuit from another	
94.	**Anderson bridge**		Self inductance is measured in terms of a standard capacitor	
95.	**Bridge circuit**		It is used to measure unknown resistance,capacitance and inductance in a circuit	
96.	**A/D & D/A**		Analog to digital conversion and digital to analog conversion	
97.	**Types of dc bridges**		Wheatstone bridge,Kelvin bridge and Kelvin double bridge	
98.	**The condition to achieve a high sensitivity in a Kelvin bridge**		The measuring current should be high enough so as to sensitize the null detector.	
99.	**Bridge sensitivity**		The bridge sensitivity is defined as the amount of deflection of the galvanometer per unit fractional change in the unknown resistance.	
100.	**Spectrum analyzer**		A spectrum analyser is a device that displays signal amplitude as it varies bysignal frequency	
		UNIT –V		
101.	**Attenuator**		A device consisting of an arrangements of resistors which reduces the strength of a radio or audio signal	
102.	**Magnetic tape recorder**		Once the data is recorded,it can be replayed an almost indefinite number of times	
103.	**Photographic recorded**		It is a device which display and store the record of physical quantity being measured	
104.	**Digital voltmeter**		Digital voltmeter give a numerical display of voltage by use of an analog to digital convertor.	
105.	**Digital plotters**		A digital plotter is acomputer output device which draws curves and other computer graphics data on ordinary.	
106.	**Printers**		A printer is the device connected to the computer that helps with the precise imaging of text and pictures on paper	
107.	**Character printer**		It prints only one character at a time	
108.	**Dot matrix printer**		It prints characters as combinations of dots.	
109.	**Laser printer**		That utilizes a laser beam to produce an image on a drum	
110.	**Inkjet printer**		It prints characters by spraying patterns of ink on the paper from nozzle or jet	
111.	**CRT**		The cathode ray tube is a vaccum tube that contains one or more electrons guns and a phosphorescent screen,and is used to display images	
112.	**CRO**		CRO is a type of electrical instrument which is used for showing the measurement and analysis of waveform	
113.	**Data loggers**		Is an electronic device that records data over time or in relations to location either with a built in instrument or sensor.	
114.	**Hall effect**		The production of a potential difference across an electrical conductor when a magnetic field is applied in a direction perpendicular to that of the flows of current	

115.	**Smart sensor**		A smart sensor is a device that takes input from the physical environment amd uses built-in compute resources to perform predefined functions	
116.	**Electrical and electronics instrument**		Instruments which are used for measurements of electrical quantities like current,voltage and power	
117.	**Sensitivity of PMMC voltmeter**		PMMC voltmeter is defined as the deflection per unit current in the coil.	
118.	**Resolution of digital voltmeter**		$R=1/10^n$	
119.	**Delay line of CRO**		Used to delay the signal for some time in the vertical section	
120.	**LED**		A PN junction diode which emits light when forward biased,the emitted may be visible or in visible.	
121.	**LCD**		Passive type display devices used for display of numeric and alphanumeric character in dot matrix and segmented display	
122.	**Advantages of LED**		Low power consumption ,very fast action ,extremely long life	
123.	**Programmer**		An automatic sequence switch which switchs controls the operation of all other units of data logger	
124.	**Applications of LVDT**		Displacement,force,weight,pressure,position	
125.	**Application of DAS**		Aerospace application,biomedical field,telemetry industries	
126.			Which of the following is caused by careless handling? a) Systematic error b) Gross error c) Random error d) None of the mentioned Answer: b Explanation: Gross errors are mostly due to lack of knowledge, judgment and care on the part of the experiment. That is Gross error is caused by careless handling.	
127.			‘A system will be error free if we remove all systematic error’. a) True b) False Answer: b Explanation: Random errors will remain in a system even if we remove all systematic errors. Random errors are also known as residual errors.	
128.			Which standard is fixed and used for industrial laboratories? a) International standard b) Primary standard c) Secondary standard d) Working standard Answer: c Explanation: Secondary standards are fixed and used in industrial laboratories. Working standards as its name suggests is used for day to day measurements. International standards are accepted internationally and primary standards are used in different parts of world which will not be accessible outside for calibration.	

129.			Output of a bimetallic element will be _____ a) Strain b) Pressure c) Displacement d) Voltage Answer: c Explanation: Bimetallic element is used for measuring temperature, it produces proportional output displacement for input temperature.	
130.			Which of the following can be used for measuring temperature? a) Metallic diaphragm b) Fluid expansion system c) Capsule d) Bourdon tube Answer: b Explanation: Fluid expansion system is a method for measuring temperature, in which expansion of liquid is measured with temperature.	
131.			IPTS stands for _____ a) International Practical Temperature Scale b) Indian Primary Temperature Scale c) International Primary Temperature Scale d) International Practical Temperature Standard Answer: a Explanation: IPTS is the short form of name International Standard Temperature Scale.	
132.			Which of the following is used as indication instrument in a liquid expansion system? a) Bellows b) Bourdon tube c) Ammeter d) Thermometer Answer: b Explanation: Bourdon tube converts pressure into displacement and in liquid expansion systems output expansion pressure is applied to bourdon tube for indication.	
133.			Analogous quantities of heat flow and temperature in electrical are _____ and _____ a) Potential and current b) Current and potential c) Power and potential d) Current and power Answer: b Explanation: Heat flow in the thermal system is analogous to current flow in electrical, and temperature between two points is analogous to potential between two points in electrical.	
134.			Load cells are used for measuring _____ a) Large weights only b) Small weights only c) Weights moving in high speed d) Slowly moving weights Answer: d Explanation: Load cells are used for measuring weights of slowly moving bodies so that their weight will be uniformly distributed over load cell surface.	

135.			Which of the following can be measured using a Ring-type load cell? a) Large weight b) Small weight c) Both large and small weights d) None of the mentioned Answer: b Explanation: Ring type load cell consists of a ring like an arrangement to which force is applied. They are used for applications in which measurement of small forces are required.	
136.			Which of the following is detected using manometer devices? a) Pressure difference between manometric and measuring liquid b) pH difference between manometric and measuring liquid c) Density difference between manometric and measuring liquid d) None of the mentioned Explanation: In manometer devices, pressure difference between manometric liquid and measuring liquid is obtained and it is equated to relation hϱg, ϱ is the mass density of the manometric liquid.	
137.			Which of the following devices convert pressure to displacement? a) Diaphragm b) Bellow c) Capsule d) Both diaphragm and capsule Answer: d Explanation: Both diaphragm and capsule convert pressure into displacement which can be measured using indicating instruments. Displacement will be proportional to applied pressure.	
138.			SAW stands for _____ a) Sound actuated wave b) Surface acoustic wave c) Sound activated wave d) Surface activated wave Answer: b Explanation: SAW stands for surface acoustic wave.	
139.			Magnetic bio sensor is wide used for _____ a) Blood detection b) DNA detection c) ECG detection d) EMG detection Answer: b Explanation: Magnetic bio sensors are used for DNA detection.	
140.			BAW stands for _____ a) Bulk acoustic wave b) Barrier acoustic wave c) Barrier avoiding wave d) Bulk activated wave Answer: a Explanation: BAW stands for Bulk acoustic wave.	
141.			Non contacting type bio sensors are _____ a) Radiation type	

			b) Electromagnetic type c) Radiation or electromagnetic type d) None of the mentioned Answer: c Explanation: Bio sensors may be contacting or non contacting type. Non contacting type sensors may be electromagnetic or radiation type.	
142.			Glass electrode is an ion selective electrode. a) True b) False Answer: a Explanation: Glass electrode is used to measure pH which is the hydrogen ion activity.	
143.			IR sensors are used in detection of _____ a) Organic gases b) Inorganic gases c) Vapours d) All of the mentioned Answer: d Explanation: IR sensors can be used in detecting many organic inorganic gases and vapours.	
144.			Fluoride glass is used with _____ a) IR waves b) UV rays c) Normal light d) All of the mentioned Answer: a Explanation: Flouride glass is suitable for IR rays of wavelength upto 3200 nm.	
145.			Basically sound waves are _____ a) Voltage signals b) Pressure waves c) Current d) Radiation Answer: b Explanation: Sound waves are pressure waves in character.	
146.			Which of the following is not a character of a sensor of a sound wave? a) Causes no health hazard b) They are suitable in a harsh environment c) They are only suitable in cold environment d) They can be used in corrosive environment Answer: c Explanation: Sound sensors can be used in any environment.	
147.			SONAR stands for _____ a) Sound navigation and ranging b) Sound number approximation and ranging c) Sound nullifying ranging d) None of the mentioned Answer: a Explanation: Sonar is the short form of sound navigation and ranging.	
148.			Mosaic regarding sonar is _____ a) Surface of sonar b) Frequency of sound wave	

			c) Pattern of vibrating elements d) Depth of sea to which it is applicable Answer: c Explanation: Specific pattern of the vibrating element is known as mosaic.	
149.			Piezo electric materials are well cut for _____ a) Good dimension b) Good coupling coefficient c) Compact shape of device d) Increasing frequency Answer: b Explanation: Piezo electric materials are so cut as to have maximum coupling coefficient between mechanical strain and electrical polarization direction.	
150.			Magnetostriction transmitter uses _____ a) Electrostrictive phenomena b) Horizontal vibration of nickel tube c) Longitudinal vibration of nickel tube d) All of the mentioned Answer: c Explanation: Magnetostriction transmitter uses longitudinal vibration of nickel tube used.	
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Subject Expert **HOD**