

SUBJECT : BIO-MEDICAL ENGINEERING (BM)**Time:1 Hour 30 minutes****Instructions:**

1. Ensure that all pages are printed.
2. Use Black ball pen only
3. Change in option is not allowed
4. There is no negative marking
5. Use of non-programmable scientific calculator is allowed

1.	Silver chloride electrode is used as a reference electrode due to its			
	A	Large half cell potential	B	Stable half cell potential
	C	Stable resting potential	D	Stable action potential
2.	Two electrolyte solutions with different concentrations of ions with different ionic mobilities create a potential difference known as			
	A	Over potential	B	Half-cell potential
	C	Ohmic over-potential	D	Liquid-junction potential
3.	Which electrode has a zero half cell potential?			
	A	Ag/AgCl ₂	B	H ₂
	C	Cu	D	Ni
4.	Which statement is related to all or nothing law? S1: Action potential is always the same for any given cell S2: Intensity of stimulus is assumed to be greater than threshold of stimulus			
	A	S1 true, S2 false	B	S1 and S2 true
	C	S1 and S2 false	D	S1 false, S2 true
5.	When the cell membrane again changes its properties and forcing sodium out of the cell and drawing potassium ions to the inside of the cell wall is called			
	A	Depolarization	B	Polarization
	C	Action potential	D	Repolarization
6.	The intracellular K ⁺ concentration of a group of cells averages 150 X 10 ⁻⁶ moles/cm ³ . The extracellular K ⁺ concentration averages 6 X 10 ⁻⁶ moles/cm ³ . The diffusion potential for K ⁺ is			
	A	-85.3 mV	B	0.5

	C	- 35.8 mV	D	-58.3 mV
7.	In the standard 12-lead ECG recording system , the minimum number of electrodes required to be attached to a human subject for recording any one of the unipolar chest lead signal is			
	A	1	B	2
	C	4	D	5
8.	The P wave ,QRS complex and T wave in one heart cycle of the ECG waveform correspond respectively to			
	A	Polarization of atria; polarization of ventricles and re polarization of atria	B	Polarization of atria; depolarization of ventricles and re polarization of atria
	C	depolarization of atria; repolarization of ventricles and depolarization of atria	D	depolarization of atria; depolarization of ventricles and repolarization of atria
9.	In which lead position the +ve terminal of amplifier is connected to left arm and -ve terminal is connected to right arm?			
	A	Lead I	B	Lead II
	C	Lead III	D	aVF
10.	(A) 1st heart sound – (1) Beginning of systole (B) 2nd heart sound – (2) Beginning of diastole (C) 3rd heart sound – (3) Rapid filling of ventricles			
	A	A-2,B-1,C-3	B	A-3,B-1,C-2
	C	A-2,B-3,C-1	D	A-1, B-2, C-3
11.	For faithful reproduction of QRS complex of ECG signal, an amplifier band width should be			
	A	0-2000 Hz	B	0.05-100 Hz
	C	d.c. to few kHz	D	0.05-1 Hz
12.	To design multi-channel vital sign (like ECG, Body temperature, Blood pressure and Blood oxygen level) monitoring instrument, which amplifier can be used in front end of instrument			
	A	Differential chopper Amplifier	B	Logarithmic Amplifier

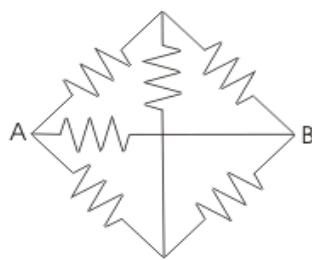
	C	Instrumentation Amplifier	D	Programmable Gain Instrumentation Amplifier
13.	To reduce common mode interference during recording of bio signals one can use			
	A	differential amplifier	B	buffer amplifier
	C	chopper amplifier	D	single ended amplifier
14.	The ranges of frequency and voltage related to EEG are			
	A	0.5 Hz to 100 Hz and 10 μ V to 100 μ V	B	DC to 10 kHz and 10 μ V to 1000 μ V
	C	0 to 100kHz and 0.1mV to few mV	D	20 Hz to 100 Hz and 0 to few mV
15.	A protection device used in most ECG preamplifier is a _____ lamp.			
	A	Neon glow lamp	B	LED lamp
	C	Halogen lamp	D	IR lamp
16.	The resting potential inside of the neuron is about			
	A	1 mV	B	100 μ V
	C	few mV	D	-70 mV
17.	To avoid electrode polarisation and bio-potential artifacts, electromagnetic blood flow meters are using			
	A	AC magnetic fields	B	DC magnetic fields
	C	d.c. current	D	circular magnets
18.	The radio activity taken up is measured by means of			
	A	Thermal detector	B	PIN diode detector
	C	IR detector	D	Scintillation detector
19.	X1: ECG interpretation is a frequency of interpretation process X2: ECG interpretation is a waveform recognition process			
	A	Both X1 and X2 are false	B	X1 is true and X2 is false
	C	Both X1 and X2 are true	D	X1 is false and X2 is true
20.	The pulse oximeter measures:			

	A	Haemoglobin level in blood	B	The amount of oxygen contained in the blood
	C	Percentage of haemoglobin saturated with oxygen	D	Cardiac output
21.	The normal pH of blood is			
	A	6.8	B	7
	C	7.4	D	7.8
22.	Cardiac output (CO) for a patient whose heart rate is 60 beats/min if the stroke volume is 50 mL/beat.			
	A	2000 mL/min	B	3000 L/min
	C	300 mL/min	D	3 L/min
23.	Which system is a chemical communications and control system within the body?			
	A	Nervous system	B	Circulatory system
	C	Endocrine system	D	Respiratory system
24.	The mercury in a manometer rises to a height of 120 mm Hg. The absolute pressure will be			
	A	120 mm Hg	B	880 mm Hg
	C	760 mm Hg	D	1 mm Hg
25.	Which temperature sensing technique will give greatest sensitivity?			
	A	RTD	B	Thermistor
	C	Thermocouple	D	Pyroelectric transducer
26.	Plethysmograph for measuring total lung capacity is based on			
	A	Boyle's law	B	Electromagnetic conduction
	C	Faraday's law of induced emf	D	Fleming's right hand rule
27.	The instrument for administering the electric shock is called			
	A	Ventillators	B	Pace maker
	C	Stimulators	D	Defibrillators

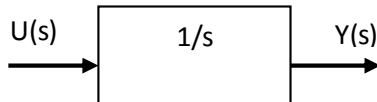
28.	Ventricular asynchronous pacemaker is also called as			
	A	Internal pace maker	B	Fixed rate pace make
	C	Inhibited pace maker	D	Demand pace maker
29.	The frequency range of 10^{17} - 10^{20} Hz is used for			
	A	X-ray imaging	B	Radar imaging
	C	Thermal imaging	D	Nuclear emission imaging
30.	Imaging of brain is difficult by using method of -----.			
	A	Monography	B	radiography
	C	Tomography	D	None
31.	Among the following imaging systems, which has more noninvasive character?			
	A	Ultrasonic imaging system	B	CT imaging system
	C	Nuclear imaging system	D	PET system
32.	_____protects against a shock that occurs if a person touches the hot lead with one hand and ground with the other.			
	A	Line isolation monitor	B	Isolation transformer
	C	Pacemaker	D	Ground fault interrupter
33.	A physiological response to a current applied to the surface of the _____ that produces muscle contraction or tissue injury is called as microshock.			
	A	Body	B	Lung
	C	Heart	D	Bones
34.	A person suddenly fall from ladder while he touches the electrical contact. What amount of the current might be passed through the body of the person?			
	A	10 mA	B	80 mA
	C	1 A	D	5 A

35.	A variable reluctance type tachometer has 60 rotor slots. If counter records 3600 counts per second, then speed is			
	A	60 rpm	B	360 rpm
	C	1800 rpm	D	3600 rpm
36.	1 cm piezoelectric transducer having a g-coefficient of 58V/kg/m^2 is subjected to a constant pressure of 10 kg/m^2 for about 15 minutes. The piezo voltage developed by the transducer will be			
	A	29 mV	B	58 mV
	C	143 mV	D	116 mV
37.	In bio-telemetry, the type of modulation employed is			
	A	Amplitude modulation	B	Pulse modulation
	C	Phase modulation	D	Frequency modulation
38.	A car is going at a constant speed of 50 km/h, which of the following is the feedback element for the driver?			
	A	Clutch	B	Eyes
	C	Needle of the speedometer	D	Steering wheel
39.	With feedback _____ increases.			
	A	system stability	B	sensitivity
	C	Gain	D	effects of disturbing signals
40.	By which of the following, the system response can be tested better ?			
	A	Ramp input signal	B	Sinusoidal input signal
	C	Unit impulse input signal	D	Exponentially decaying signal
41.	In a system zero initial condition means that			
	A	The system is at rest and no energy is stored in any of its components	B	The system is working with zero stored energy
	C	The system is working with zero reference signal	D	none of the above
42.	If the gain of the critical damped system is increased, it will behave as			

	A	Oscillatory	B	critically damped
	C	Overdamped	D	underdamped
43.	<p>A given system is characterized by the differential equation: $\frac{d^2y(t)}{dt^2} - \frac{dy(t)}{dt} - 2y(t) = x(t)$. The system is</p>			
	A	linear and unstable	B	linear and stable
	C	nonlinear and stable	D	nonlinear and unstable
44.	The FT of a rectangular pulse existing between $t = -T/2$ to $t = T/2$ is a			
	A	sinc squared function	B	sine squared function
	C	sine function	D	sinc function
45.	The continuous time system described by $y(t) = x(t^2)$ is			
	A	causal, non-linear and time varying	B	non causal, non-linear and time-invariant
	C	causal, linear and time varying.	D	non causal, linear and time-invariant
46.	Among the following things which have the highest attenuation of ultrasound?			
	A	Blood	B	Fat
	C	Muscle	D	Bone
47.	A digital-to-analog converter with a full-scale output voltage of 3.5 V has a resolution close to 14 mV. Its bit size is			
	A	4	B	16
	C	8	D	12
48.	An ammeter of range 0-25A has guaranteed accuracy of 1% of full scale reading. The current measured by ammeter is 5A. Limiting error in the reading is			
	A	2%	B	2.5%
	C	4%	D	5%
49.	The maximum percentage quantization error for a 12-bit analog and digital converter is			
	A	$\pm 0.00076\%$	B	$\pm 3.125\%$

	C	$\pm 0.012207\%$	D	$\pm 4.17\%$
50.	Op-amp has slew rate of $0.67\text{ V}/\mu\text{s}$, maximum rise of op-amp output in $3\text{ }\mu\text{sec}$ is			
	A	$0.67\text{ }\mu\text{V}$	B	$3\text{ }\mu\text{V}$
	C	0.67 V	D	3 V
51.	In order to remove respiration related motion artifacts from an ECG signal, the following filter should be used			
	A	High-pass filter with $F_c=0.5\text{ Hz}$	B	Low-pass filter with $F_c=0.5\text{ Hz}$
	C	Band-pass filter with passband between 0.1 Hz and 0.5 Hz	D	High-pass filter with $F_c=49.5\text{ Hz}$
52.	Introduction of dielectric:			
	A	Increases the capacitance	B	Reduces the breakdown voltage
	C	Reduces the mechanical voltage	D	Increases the size of the capacitor
53.	According to AAMI, the patient electrode offset potential required to overcome in ECG measurement is around			
	A	600 mV	B	300 mV
	C	1000 mV	D	100 mV
54.	The frequency response of a diagnostic ECG machine is from 0.05 to			
	A	45 Hz	B	60 Hz
	C	100 Hz	D	120 Hz
55.	Average resistance of human body is:			
	A	500 ohms	B	1000 ohms
	C	1500 ohms	D	2000 ohms
56.	When all the resistances in the circuit are of $1\text{ }\Omega$ each, the equivalent resistance across the points A and B will be			
				

	A	0.5 Ω	B	1 Ω
	C	1.5 Ω	D	2 Ω
57.	A circuit with resistor, inductor, capacitor in series is resonant of 50 Hz. If all the values are now doubled, the new resonant frequency is			
	A	$f_0/2$	B	$f_0/4$
	C	$2f_0$	D	still f_0
58.	The meters X and Y require 40 mA and 50 mA respectively, to give full deflection, then			
	A	both are equally sensitive	B	X is more sensitive
	C	Y is more sensitive	D	sensitivity cannot be judged with given information
59.	A variable reluctance type tachometer has 60 rotor slots. If counter records 3600 counts per second, then speed is			
	A	360 rpm	B	60 rpm
	C	3600 rpm	D	1800 rpm
60.	The main advantage of crystal oscillator is that its output is:			
	A	A Constant frequency range	B	DC
	C	50 Hz to 60 Hz	D	Variable frequency
61.	The range of an analog transducer is 0-10V. For a resolution of 5 mV, the bits of ADC will be			
	A	8	B	9
	C	10	D	11
62.	CMRR of a differential Amplifier is 10000. If it has a difference mode gain is 100, then common mode gain will be			
	A	0.001	B	0.01
	C	0.1	D	1
63.	In a LVDT, the two secondary voltages			
	A	Are independent of the core position	B	Vary unequal depending on the core position

	C	Vary equal depending on the core position	D	Are always in phase quadrature
64.	Two systems with impulse responses $h_1(t)$ and $h_2(t)$ are connected in cascade. Then the overall impulse response of the cascaded system is given by			
	A	product of $h_1(t)$ and $h_2(t)$	B	sum of $h_1(t)$ and $h_2(t)$
	C	convolution of $h_1(t)$ and $h_2(t)$	D	subtraction of $h_2(t)$ from $h_1(t)$
65.	<p>Assuming zero initial condition, the response $y(t)$ of the system given below to a unit step input $u(t)$ is</p> 			
	A	$u(t)$	B	$tu(t)$
	C	$t^2/2 u(t)$	D	$e^{-t} u(t)$
66.	<p>Consider the following statements regarding time domain analysis of a control system</p> <ol style="list-style-type: none"> 1. Integral control can convert a second order system into a third order system. 2. Derivative control improves system's transient performance. 3. Integral control does not improve system's steady state performance 			
	A	1 and 2 are correct.	B	1 and 3 are correct
	C	2 and 3 are correct.	D	1, 2 and 3 are correct
67.	In a sampled data control system, delay introduced by sampling and reconstruction process is approximately equal to			
	A	sampling interval	B	twice the sampling interval
	C	half the sampling interval	D	none of the above
68.	Capacitive transducer is superior to inductive type for measurement of capacitance because of			
	A	absence of non-linearity	B	high frequency response
	C	small size	D	high accuracy
69.	If low pressure of 10^{-6} mm of Hg is required to be measured, we should use			

	A	compound pressure gauge	B	thermocouple vacuum gauge
	C	Pirani gauge	D	ionization type vacuum gauge
70.	A piezoelectric force transducer has a charge sensitivity of 20 pC/N. It is connected to a charge amplifier and overall gain of transducer and amplifier is 50 mV/N. The gain of amplifier is			
	A	1 mV/pC	B	1.5 mV/pC
	C	2.5 mV/pC	D	4 mV/pC
71.	A 2 MHz signal will be a(n) _____ wave if radiated by an antenna and a(n) _____ wave if radiated by a piezoelectric crystal.			
	A	Acoustical signal, electromagnetic	B	Infrared signal, Hearing signal
	C	Electromagnetic, acoustical signal	D	none
72.	A motor that translates electrical pulses into fixed mechanical movements is called _____.			
	A	Brushless DC motor	B	Induction motor
	C	DC servo motor	D	Stepper motor
73.	A differential pressure transmitter is calibrated for 0-100 W.C. and the output range is 4-20 mA. When 36" differential is applied to the transmitter, the correct output is:			
	A	8.27 mA	B	5.76 mA
	C	12.27 mA.	D	9.76 mA.
74.	Catheter tip transducer have			
	A	maximum time delay	B	minimum time delay
	C	no time delay	D	infinite time delay
75.	Which technique is not applicable for blood flow measurement?			
	A	Electromagnetic technique	B	Ultrasonic Technique
	C	NMR technique	D	Orifice type flow meter
76.	_____ is a part of the human temperature control system.			
	A	Digestive system	B	Perspiration system

	C	Ear	D	Leg movement
77.	The overshoot (an indication of the largest error between the actual and desired output) is the ratio of			
	A	Transient error to peak error	B	Dynamic error to peak error
	C	Maximum overshoot to final desired value	D	None of the above
78.	An inverse transducer is a device which converts			
	A	An electrical quantity into a non electrical quantity	B	Electrical energy into thermal energy
	C	Electrical quantity into mechanical quantity	D	Electrical energy into light energy
79.	_____ is the example of photo emissive cell.			
	A	LDR	B	Photo diode
	C	Photo transistor	D	Photo multiplier
80.	In ADC the time required to complete one sample determines the			
	A	Maximum conversion time	B	Sampling rate
	C	Settling time	D	Minimum sampling time
81.	Which of following is a characteristic equation of a square matrix A? (a) $ A - \lambda I = 0$ (b) $ A + \lambda I = 0$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
82.	System of linear equation is said to be consistent if (a) It has unique solution (b) It has infinite solution			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
83.	If c, is an Eigen value of matrix A then in general which of following is correct? (a) c^2 is Eigen value of A^2 (b) c^{-1} is Eigen value of A			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these

84.	If at $x = a$, function $y = f(x)$ has local maxima then in general which of following is correct? (a) $f'(a) = 0$ (b) $f''(a) > 0$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
85.	If $u(x,y) = \sin(xy)$ then which of following is correct (a) $u_x(x,y) = y\cos(xy)$ (b) $u_x(x,y) = \cos(xy)$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
86.	$\int_{-1}^1 x dx = \underline{\hspace{2cm}}$			
	A	0	B	$\frac{1}{2}$
	C	-1	D	None of these
87.	Rate of change of a fluid per unit volume is calculate by finding _____ of velocity function			
	A	Gradient	B	Divergence
	C	Curl	D	Differentiation
88.	What is the length of the curve $\vec{r}(t) = (\cos t)\hat{i} + (\sin t)\hat{j}$ from $t = 0$ to $t = \frac{\pi}{2}$			
	A	$\frac{\pi}{2}$	B	π
	C	$\frac{\pi}{4}$	D	None of these
89.	If A and B are two events in sample space S, then in general which of following is correct? (a) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (b) $P(A \cup B) = P(A) + P(B)$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
90.	Ranga Kutta Method is use for (a) solution of differential equation (b) calculation of definite integral			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
91.	$M(x,y)dx + N(x,y)dy = 0$ is exact differential equation if			

	A	$\frac{\partial M}{\partial x} = \frac{\partial N}{\partial y}$	B	$\frac{\partial M}{\partial y} = \frac{\partial N}{\partial x}$
	C	$\frac{\partial M}{\partial x} = -\frac{\partial N}{\partial y}$	D	$\frac{\partial M}{\partial y} = -\frac{\partial N}{\partial x}$
92.	Solution of $\frac{d^2 y}{dx^2} = 0$ with $y(0) = 0$ is _____			
	A	Set of all circles with centre (0,0)	B	Set of all parabolas passing from (0,0)
	C	Set of all circles passing from (0,0)	D	set of all line passing from (0,0)
93.	Which of following is solution of $y'' - y' - 6y = 0$ (a) e^{3x} (b) e^{-2x}			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
94.	Laplace transform of a function $f(t)$ is _____			
	A	$\int_0^1 e^{-st} f(t) dt$	B	$\int_0^\infty e^{st} f(t) dt$
	C	$\int_0^1 e^{st} f(t) dt$	D	$\int_0^\infty e^{-st} f(t) dt$
95.	Which of following is correct for Laplace Transform (a) $L(\sin at) = \frac{s}{s^2 - a^2}$ (b) $L(\cos at) = \frac{a}{s^2 - a^2}$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
96.	Which of following is harmonic function (a) $u(x,y) = x^2 - y^2$ (b) $u(x,y) = x^2 + y^2$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
97.	Which of following is correct (a) Sequence $u_n = \frac{n!}{n^n}$ is convergent (b) $\sum_{n=1}^\infty \frac{n!}{n^n}$ is convergent			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these
98.	If $f(z) = u(x,y) + iv(x,y)$ is an analytic function then which of following is correct (a) $u_x = v_y$ (b) $u_{xx} + u_{yy} = 0$			
	A	Only (a)	B	Only (b)
	C	Both (a) and (b)	D	None of these

99.	For complex valued function $f(z) = \frac{z+i}{(z-3)(z+4)^3}$ which of following is correct			
	(a) 3 is regular point (b) f(z) has a simple pole at $z = 3$			
	A	Only (a)	B	Only (b)
100.	C	Both (a) and (b)	D	None of these
	$\oint_C \frac{e^z}{z-4} dz = \underline{\hspace{2cm}}$, where C is a unit circle.			
	A	1	B	0
	C	e^4	D	None of these
