

Seat No. _____

SUB INSTRUMENTATION AND CONTROL ENGINEERING (IC)

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.	The signal given by the equation $\sum_{n=-\infty}^{\infty} x(n) ^2$ is known as _____			
	A	Energy signal	B	Power signal
	C	Work done signal	D	None of the mentioned
2.	A real valued signal $x(n)$ is called as anti-symmetric if _____			
	A	$x(n)=x(-n)$	B	$x(n)= -x(-n)$
	C	$x(n)= -x(n)$	D	none of the mentioned
3.	The odd part of a signal $x(t)$ is?			
	A	$x(t)+x(-t)$	B	$x(t)-x(-t)$
	C	$(1/2)*(x(t)+x(-t))$	D	$(1/2)*(x(t)-x(-t))$
4.	Which among the following gases have diamagnetic property (ability to be repelled by magnetic fields)?			
	A	Oxygen	B	Nitrogen
	C	Nitrogen dioxide	D	Nitric oxide
5.	Which of the following gases have paramagnetic property (ability to get attracted to a magnetic field)?			
	A	Nitric oxide	B	Hydrogen
	C	Helium	D	Nitrogen
6.	Which of the following happens to the magnetic susceptibility of gases when the temperature changes?			
	A	It increases with increase in temperature	B	It decreases with increase in temperature
	C	It remains constant with increase in temperature	D	It remains constant with decrease in temperature
7.	In chromatogram, the area under the peak can be used to determine which of the following?			

	A	Components of the sample	B	Amount of component in the sample
	C	Column efficiency	D	Column resolution
8.	In chromatography, the stationary phase can be _____ supported on a solid.			
	A	Solid or liquid	B	Liquid or gas
	C	Solid only	D	Liquid only
9.	Which of the following is the formula for pH calculation?			
	A	$\log_{10}[\text{H}^+]$	B	$-\log_{10}[\text{H}^+]$
	C	$\log_2[\text{H}^+]$	D	$-\log_2[\text{H}^+]$
10.	Mass spectrometers are used to determine which of the following?			
	A	Composition in sample	B	Concentration of elements in sample
	C	Relative mass of atoms	D	Properties of sample
11.	During a measurement, for a measure value “b”, absolute error is obtained as “A”, what will be the relative error of measurement?			
	A	A/B	B	B/A
	C	(A+1)/B	D	(B+A)/A
12.	Using a voltmeter measured value is 24.3V, while its true value is 24V. What is the relative error of measurement?			
	A	1.25%	B	1.2%
	C	1.3%	D	1.4%
13.	Which of the following cannot be treated as a requirement of the instrumentation amplifier?			
	A	Low drift	B	Low input impedance
	C	High linearity	D	High CMRR
14.	If input frequency is 50Hz then ripple frequency of bridge full wave rectifier will be equal to _____			
	A	200Hz	B	50Hz
	C	45Hz	D	100Hz
15.	Which of the following configuration is used as input stage of the multistage amplifier?			
	A	Common base configuration	B	Common emitter configuration
	C	Common collector configuration	D	All configurations are equally suited
16.	Which of the following configuration is used for impedance matching?			
	A	Common base configuration	B	Common emitter configuration
	C	Common collector configuration	D	All configurations are equally suited

17.	Phase shift provided by one phase shift network in RC phase shift oscillator in 3 stage is _____		
	A	180 degrees	B 60 degrees
	C	120 degrees	D 90 degrees
18.	Which type of feedback is used by Colpitts oscillator?		
	A	Voltage series feedback	B Current series feedback
	C	Voltage shunt feedback	D Current shunt feedback
19.	For a Zener diode shunt regulator, the source current is I_S , the Zener diode current is I_Z and the load current is I_L . The source voltage is V_S , Zener voltage is V_Z and load voltage is V_L . The load resistance is R_L . What is the correct option for the safe operation of the diode?		
	A	$I_S = I_Z + I_L$	B $I_S \leq I_{Zmax} + I_L$
	C	$I_S \leq I_{Zmin} + I_L$	D $V_L = V_Z$
20.	Given that CMRR is 100dB for OPAMP. Input common-mode voltage is 12 V. Differential voltage gain is 4000. Calculate output common-mode voltage.		
	A	48V	B 0.48V
	C	20V	D 11V
21.	The unity gain bandwidth for an op-amp having open loop gain 2×10^6 is 10 Mhz. Calculate the AC gain of op-amp at an input of 2000 Hz.		
	A	2000	B 5000
	C	10000	D 12.5
22.	Consider a practical op-amp where the power supply is $V_{CC} = +12V$ and $V_{EE} = -12V$. The open loop gain is 106 and open loop bandwidth is 5Hz. What is the maximum positive input before which the output is saturated?		
	A	12 mV	B 0.012 mV
	C	24 mV	D 12V
23.	Which of the following quantities cannot be measured using piezoelectric transducers?		
	A	Pressure	B Strain
	C	Acceleration	D None of the mentioned
24.	A linear system at rest is subject to an input signal $r(t) = 1 - e^{-t}$. The response of the system for $t > 0$ is given by $c(t) = 1 - e^{-2t}$. The transfer function of the system is:		
	A	$(s+2)/(s+1)$	B $(s+1)/(s+2)$
	C	$2(s+1)/(s+2)$	D $(s+1)/2(s+2)$
25.	A control system whose step response is $-0.5(1 + e^{-2t})$ is cascaded to another control block whose impulse response is e^{-t} . What is the transfer function of the cascaded combination?		
	A	$1/(s+2)(s+1)$	B $1/(s+1)s$
	C	$1/(s+3)$	D $0.5/(s+1)(s+2)$

26.	Standard test signals in control system are:			
	A	Impulse signal	B	Ramp signal
	C	Unit step signal	D	All of the mentioned
27.	Consider a system with transfer function $G(s) = \frac{s+6}{Ks^2+s+6}$. Its damping ratio will be 0.5 when the values of k is:			
	A	2/6	B	3
	C	1/6	D	6
28.	For the system $\frac{2}{(s+1)}$, the approximate time taken for a step response to reach 98% of its final value is:			
	A	1s	B	2s
	C	4s	D	8s
29.	The superposition theorem is :			
	A	Homogeneity	B	Additivity
	C	Combination of homogeneity and additivity	D	Applied to non-linear systems
30.	In non-linear system stability is :			
	A	Dependent on the input	B	Independent on initial state
	C	Independent on input	D	Dependent on input and initial state.
31.	Determine the centroid of the root locus for the system having $G(s)H(s) = \frac{K}{(s+1)(s^2+4s+5)}$			
	A	-2.1	B	-1.78
	C	-1.66	D	-1.06
32.	The intersection of asymptotes of root loci of a system with open loop transfer function $G(s)H(s) = \frac{K}{s(s+1)(s+3)}$ is			
	A	1.44	B	1.33
	C	-1.44	D	-1.33
33.	The forward path transfer function of a unity feedback system is given by $G(s) = \frac{100}{(s^2+10s+100)}$. The frequency response of this system will exhibit the resonance peak at:			
	A	10 rad/sec	B	8.66 rad/sec
	C	7.07 rad/sec	D	5rad/sec
34.	The critical value of gain for the system is 40. The system is operating at a gain of 20. The gain margin of the system is			
	A	2 dB	B	3 dB

	C	6 dB	D	4 Db
35.	For the SCR to remain in the ON (conducting) state			
	A	gate signal is continuously required	B	no continuous gate signal is required
	C	no forward anode-cathode voltage is required	D	negative gate signal is continuously required
36.	In 8051 microcontroller, DAA command adds 6 to the nibble if:			
	A	CY and AC are necessarily 1	B	either CY or AC is 1
	C	no relation with CY or AC	D	CY is 1
37.	In 8051 microcontroller, 8 bit signed number operations, OV flag is set to 1 if:			
	A	a carry is generated from D7 bit	B	a carry is generated from D3 bit
	C	a carry is generated from D7 or D3 bit	D	a carry is generated from D7 or D6 bit
38.	In 8051 microcontroller, Which of the following combination is the best to enable the external hardware interrupt 0 of the IE register (assuming initially all bits of the IE register are zero)?			
	A	EX0=1	B	EA=1
	C	any of the mentioned	D	EX0=1 & EA=1
39.	In 8051 microcontroller, the instruction "MOV TH1,# -3", what is the value that is being loaded in the TH1 register?			
	A	0xFCH	B	0xFBH
	C	0xFDH	D	0xFEH
40.	When the 8051 microcontroller executes some arithmetic operations, then the flag bits of which register are affected?			
	A	PSW	B	SP
	C	DPTR	D	PC
41.	Thermal conductivity gauge is used to measure			
	A	flow	B	pressure
	C	temperature	D	level
42.	Piezoelectric transducer cannot measure			
	A	Static pressure	B	Dynamic pressure
	C	Static and dynamic pressure	D	None of these
43.	In automatic process control systems, the signal adjusted/modified by final control is also called			
	A	Controlled variable	B	disturbance
	C	Set-point	D	Manipulated variable

44.	A pneumatic pressure transmitter is calibrated to a pressure range of 100 to 500 psi. The signal output is 10.2 psi. What is the measured pressure in psi?			
	A	340 psi	B	272 psi
	C	330 psi	D	267 psi
45.	Anti-wind up effect seen in controlled variable , because of			
	A	Derivative control action	B	Proportional control action
	C	Actuator saturation limit	D	All of these
46.	Effect of Dead time in plant transfer function is approximated by			
	A	Fourier series expansion	B	Discrete time fourier transform
	C	taylor series expansion with pade approximation	D	z-transform
47.	The Z-transform of $\left(\frac{1}{2}\right)^n u(n)$ is			
	A	$\frac{z}{z + \frac{1}{2}}; ROC \text{ is } z > \frac{1}{2}$	B	$\frac{z}{z - \frac{1}{2}}; ROC \text{ is } z < \frac{1}{2}$
	C	$\frac{z}{z - \frac{1}{2}}; ROC \text{ is } z > \frac{1}{2}$	D	$\frac{1}{z - \frac{1}{2}}; ROC \text{ is } z > \frac{1}{2}$
48.	If analog signal $x(t)=2\cos 100\pi t$ is sampled at 75HZ then discrete time signal obtained after sampling is			
	A	$2\cos \frac{2\pi}{3}n$	B	$2\cos \frac{4\pi}{3}n$
	C	Both (a) and (b)	D	Neither (a) nor (b) is correct
49.	The nyquist rate for a continuous time signal $s(t)=5\cos 50\pi t+20\sin 300\pi t-10\cos 100\pi t$ is			
	A	150	B	50
	C	300	D	600
50.	The number of flip flops required in a decade counter is			
	A	2	B	4
	C	8	D	16
51.	When magnetic flow meter is used to measure flow, the meter must be			
	A	Full at all times	B	Partially full all the time
	C	Empty at all times	D	Either full or partially full all times
52.	The normalized average power P of a discrete-time signal $x[n]$ is defined as			
	A	$\lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^{n=N} x[n] ^2$	B	$\lim_{N \rightarrow \infty} \frac{1}{N+1} \sum_{n=-N}^{n=N} x[n] ^2$
	C	$\lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^{n=N} x[n] ^3$	D	$\lim_{N \rightarrow \infty} \frac{1}{2N+1} \sum_{n=-N}^{n=N} x[n] ^3$

53.	If $x(t)$ is a finite duration signal, that is, $x(t) = 0$ except in a finite interval $t_1 \leq t \leq t_2$ ($-\infty < t_1$ and $t_2 < \infty$) then ROC is			
	A	the entire s-plane except possibly $s=0$ or $s=\infty$	B	the entire left half of s-plane
	C	the entire right half of s-plane	D	the entire s-plane
54.	An ideal band pass filter (BPF) is specified by			
	A	$ H(w) = \begin{cases} 1 & ; w_1 < w < w_2 \\ 0 & ; otherwise \end{cases}$	B	$ H(w) = \begin{cases} 1 & ; w < w_c \\ 1 & ; w > w_c \end{cases}$
	C	$ H(w) = \begin{cases} 0 & ; w < w_c \\ 1 & ; w > w_c \end{cases}$	D	$ H(w) = \begin{cases} 1 & ; w < w_c \\ 0 & ; w > w_c \end{cases}$
55.	If $x(t)$ and it's first derivatives are Laplace transformable and the Laplace transform of $x(t)$ is $X(s)$, then $\lim_{t \rightarrow \infty} x(t)$ is given by			
	A	$\lim_{s \rightarrow \infty} s x(s)$	B	$\lim_{s \rightarrow 0} s x(s)$
	C	$\lim_{s \rightarrow \infty} \frac{x(s)}{s}$	D	$\lim_{s \rightarrow 0} \frac{x(s)}{s}$
56.	Laplace transform of $e^{-at} \sin wt$ is			
	A	$\frac{w}{(s+a)^2 + w^2}$	B	$\frac{w}{(s-a)^2 + w^2}$
	C	$\frac{w}{(s-a)^2 - w^2}$	D	$\frac{w}{(s+a)^2 - w^2}$
57.	The FIR digital filter is always			
	A	BIBO stable	B	BIBO unstable
	C	BIBO stable and unstable	D	None of these
58.	FIR digital filter have			
	A	Recursive response	B	Non recursive response
	C	Random response	D	None of these
59.	IIR digital filter have			
	A	Random response	B	Non recursive response
	C	Recursive response	D	None of these
60.	The laplace transform of time function $e^{-at} \sin \omega t$ is			

	A	$\frac{s}{s^2 + w^2}$	B	$\frac{w}{(s + a)^2 + w^2}$
	C	$\frac{s}{(s + a)^2 + w^2}$	D	$\frac{\omega}{s^2 + w^2}$
61.	The z-transforms of $a^n u[n]$ is			
	A	$\frac{z}{z - a}, ROC \text{ is } z > a $	B	$\frac{z}{z - a}, ROC \text{ is } z < a $
	C	$\frac{z}{z + a}, ROC \text{ is } z > a $	D	$\frac{a}{z - a}, ROC \text{ is } z > a $
62.	The z-transforms of $-a^n u[-n - 1]$ is			
	A	$\frac{z}{z - a}, ROC \text{ is } z > a $	B	$\frac{z}{z - a}, ROC \text{ is } z < a $
	C	$\frac{z}{z + a}, ROC \text{ is } z > a $	D	$\frac{a}{z - a}, ROC \text{ is } z > a $
63.	The period of the signal $x(t) = 2\sin 2t + 2\cos \sqrt{2} t$ is			
	A	$2\sqrt{2}$	B	$\sqrt{2}$
	C	$\frac{1}{\sqrt{2}}$	D	Not periodic
64.	If the impulse response of system is $h(n) = \delta(n) + \delta(n + 1) - \delta(n - 1)$. The system is			
	A	Causal and stable	B	Neither Causal nor stable
	C	Not Causal but stable	D	Causal but not stable
65.	Given $x(n), -8 \leq n \leq 7$ and $y(n), -3 \leq n \leq 2$. Then the range of their convolution is			
	A	$-8 \leq n \leq 7$	B	$-11 \leq n \leq 9$
	C	$-8 \leq n \leq 2$	D	$-6 \leq n \leq 4$
66.	Average power of unit step sequence is			
	A	$\frac{1}{2}$	B	infinite
	C	Zero	D	1
67.	The negative feedbackinput impedance of an amplifier			
	A	Decreases	B	Either of A and D
	C	None of these	D	increases
68.	Flapper nozzle is a basic functional component of			
	A	Voltage to current converter	B	Current to voltage converter
	C	Voltage to frequency converter	D	Pneumatic to current converter
69.	The phase margin for stable feedback system			
	A	Is always positive	B	Is always negative
	C	May be positive or negative	D	None of these

70.	Higher value of ripple factor indicates			
	A	Ideal rectification	B	Poor rectification
	C	r.m.s value equal to peak value	D	None of these
71.	If fifty percentage of valve lift produces 50 % of valve flow, then such valve must have			
	A	Linear characteristic	B	Non Linear characteristic
	C	Equal percentage characteristic	D	Quick opening characteristic
72.	The principle of pirani gauge is based onof the medium			
	A	Thermal conductivity	B	combustibility
	C	Humidity	D	turbidity
73.	Operation of thermocouple is governed by _____			
	A	Peltier effect	B	Seebeck effect
	C	Thomson effect	D	All of the mentioned
74.	Which of the following is a binary weighted DAC?			
	A	R-2R ladder DAC	B	PWM DAC
	C	Switched resistor DAC	D	Sampling DAC
75.	Thermistors have Temperature coefficient.			
	A	High and negative	B	Low and positive
	C	Low and negative	D	High and positive
76.	A full adder can be made of			
	A	Two half adders and a OR gate	B	Two half adders and a NOR gate
	C	Two half adders and a AND gate	D	Two half adders and a NAND gate
77.	HART stands for			
	A	highway addressable remote transmitter	B	highway addressable remote transformer
	C	highway addressable remote transducer	D	high addressable remote transducer
78.	The dc load line of a transistor circuit			
	A	Is a curved line	B	Has a negative slope
	C	Does not contain the Q point	D	Gives graphic relation between I_c and I_B
79.	In venturi type of flow meter, area of restriction is			
	A	Fixed	B	variable
	C	Dynamically changing	D	Not needed
80.	With reference to proportional controller, Gain and proportional bands are			
	A	Adjusted independently of one another	B	Reciprocally related
	C	Two different control modes	D	Controller functions calibrated in time units
81.	The integrating factor of the linear differential equation $\frac{dy}{dx} + \frac{y}{x} = \sin x$ is.....			
	A	Y	B	$\ln x$
	C	e^x	D	x

82.	Which of the following is an iterative method for solving system of linear equations?			
	A	Gauss elimination	B	Crout's
	C	matrix inversion	D	relaxation
83.	The particular integral of $\frac{d^2 y}{dx^2} + a^2 y = e^{iax}$			
	A	$\frac{1}{2ai} e^{iax}$	B	$\frac{x}{2a} e^{ax}$
	C	$\frac{x}{2ai} e^{iax}$	D	None of these
84.	The general solution of n^{th} order ordinary differential equation contains.....			
	A	(n - 1) arbitrary constants	B	n arbitrary constants
	C	(n - 2) arbitrary constants	D	n! arbitrary constants
85.	Which of following complex functions is not analytic?			
	A	z^2	B	$\sin z$
	C	\bar{z}	D	None of these
86.	$\oint_c \frac{e^z}{z-2} dz = \text{_____}$, where c is a circle $ z =3$			
	A	e^2	B	0
	C	$2\pi i$	D	$2\pi i e^2$
87.	The Laplace transform of $\sin^2 t$ is			
	A	$\left(\frac{1}{s} - \frac{s}{s^2 + 4}\right) \frac{1}{2}$	B	$\left(\frac{1}{s} - \frac{s}{s^2 + 4}\right) \frac{1}{4}$
	C	$\frac{1}{s} - \frac{s}{s^2 + 4}$	D	None of these
88.	$L^{-1}\left(\frac{1}{(s^2 + 6s + 18)}\right)$ equals			
	A	$\frac{1}{3} e^{-3t} \sin 3t$	B	$\frac{1}{3} e^{-2t} \sin 2t$

	C	$\frac{1}{3}e^{-3t} \cos 3t$	D	$e^{-3t} \sin 3t$
89.	The convergence of which of the following methods is sensitive to the starting value?			
	A	False position	B	Gauss-Seidel method
	C	Newton-Raphson method	D	All of above
90.	The value of $\int_0^1 \frac{1}{1+x^2} dx$ taking $h = 1/6$ by Simpson's 3/8 rule is most nearly to			
	A	7.8539	B	0.78539
	C	0.26179	D	1
91.	Using Taylor series method, the solution of $\frac{dy}{dx} = 1 + y^2$, $y(0) = 0$ at $x = 0.2$ is....			
	A	2.0227	B	0.2027
	C	0.4227	D	0.1014
92.	A fair dice is tossed. Let the random variable X denote the twice the number appearing on the die. The variance of the probability distribution of X is			
	A	11.67		7
	C	60.67		can't be determined
93.	The mean and variance of a binomial distribution are 8 and 4 respectively. Then $p(x=1)$ is equal to			
	A	$\frac{1}{2^{12}}$	B	$\frac{1}{2^4}$
	C	$\frac{1}{2^6}$	D	$\frac{1}{2^8}$
94.	Which of the following is a measure of central value?			
	A	Standard deviation	B	Mean deviation
	C	Median		Quartile deviation
95.	If $A = \begin{bmatrix} 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$ then eigen values of A^3 are.....			
	A	-1, -1, 2	B	-1, -1, 8

	C	1, 1, - 8	D	None of these
96.	What is the value of $\sqrt{\frac{5}{2}}$, where the symbol $\sqrt{}$ stands for gamma function?			
	A	$\frac{5}{2}$	B	$\frac{3}{4}$
	C	$\sqrt{\pi}$	D	None of these
97.	The function $f(x, y) = 2x^2 - 2y^2 - x^4 + y^4$ has saddle point at			
	A	(0, 0)	B	(0,1)
	C	(1, 0)	D	(1,1)
98.	The directional derivative of $f(x, y) = x^2 \sin 2y$ at the point $\left(1, \frac{\pi}{2}\right)$ in the direction of $\vec{a} = 3\hat{i} - 4\hat{j}$ is.....			
	A	$-2\hat{j}$	B	$\frac{3}{5}\hat{i} - \frac{4}{5}\hat{j}$
	C	$\frac{8}{5}$	D	None of these
99.	The curl of \vec{F} , where $\vec{F} = \text{grad}(x^3 + y^3 + z^3 - 3xyz)$ is			
	A	$(3x^2 - 3yz)\hat{i} + (3y^2 - 3xz)\hat{j} + (3z^2 - 3xy)\hat{k}$	B	0
	C	\vec{F}	D	$\vec{0}$
100.	The partial differential equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$, where $c > 0$ is.....			
	A	parabolic	B	hyperbolic
	C	elliptic	D	None of these
