

# PGCET-2023

Seat No. \_\_\_\_\_

SUB: Instrumentation and Control

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.	While forming a Routh array, the situation of a row of zeros indicates that the system			
	A	Is stable	B	Is insensitive to variations in gain
	C	Has symmetrically located roots	D	Has asymmetrically located roots
2.	The transfer function of a system is $T(s) = \frac{100}{(s+1)(s+100)}$ . For a unit step input to the system, the approximate settling time for 2 % tolerance band in steady state is			
	A	100 sec	B	4 sec
	C	1 sec	D	0.01 sec
3.	The transient response of second order under damped system starting from rest is given by $c(t) = Ae^{-6t} \sin(8t)$ , $t \geq 0$ . The natural frequency of system is			
	A	10	B	9
	C	8	D	100
4.	The open loop transfer function of a unity negative feedback control system is given by $G(s) = \frac{K}{s(s+2)}$ . For the peak overshoot of the closed loop system to unit step input to be 10%, the value of K is			
	A	5.252	B	2.867
	C	6.291	D	4.963
5.	A unity negative feedback control system has closed loop transfer function $T(s) = \frac{2}{(s+2)}$ . The rise time with a unit step input is			
	A	2.2 sec	B	1.1 sec
	C	0.5 sec	D	5 sec
6.	A unity negative feedback control system has closed loop transfer function $T(s) = \frac{2}{(s+2)}$ . The settling time ( 2% Tolerance Band) with a unit step input is			
	A	2 sec	B	1 sec
	C	4 sec	D	5

7.	A unity negative feedback control system has open loop transfer function $G(s) = \frac{K}{s(s+10)}$ . The gain K for the system to have damping ratio of 0.25 is			
	A	40	B	50
	C	30	D	60
8.	The forward path transfer function of a unity feedback control system is given by $(s) = \frac{20}{s^2+3s+60}$ . The steady state error to unit step input is			
	A	1	B	0
	C	$\infty$	D	0.75
9.	The loop gain $G(s)H(s)$ of a closed loop system is given by $\frac{K}{s(s+2)(s+4)}$ . The value of K for which the system just becomes unstable is			
	A	K=24	B	K=6
	C	K=4	D	K=48
10.	If the root locus branches do not cross the imaginary axes the system is			
	A	Inherently stable	B	Conditionally stable
	C	Likely to be unstable	D	Marginally stable
11.	The RMS value of $x(t) = 10 \cos(5t) \cos(10t)$ is			
	A	25	B	5
	C	50	D	10
12.	$X(t) = u(t) - u(t-10)$ is a			
	A	Power signal	B	Energy signal
	C	Neither (A) or (B)	D	Both (A) and (B)
13.	A signal is a power signal if			
	A	Energy = 0, power=finite	B	Energy = infinite, power=finite
	C	Energy = finite, power=finite	D	Energy = infinite, power= infinite
14.	A signal is a energy signal if			
	A	Energy = 0, power=0	B	Energy = infinite, power=finite
	C	Energy = finite, power=0	D	Energy = finite, power= infinite

15.	$y(t) = x^2(t)$ is for a			
	A	linear time invariant system	B	Non linear time invariant system
	C	Linear time varying system	D	Non-causal system
16.	$y(t) = t^2 x(t)$ is for			
	A	Linear system	B	Time varying system
	C	Causal system	D	Linear time varying causal system
17.	A trigonometric Fourier series has			
	A	A one sided spectrum	B	A two sided spectrum
	C	Both one sided and two sided spectrum	D	none
18.	In a series resonance circuit, series resonance occurs when?			
	A	capacitive reactance is equal to the inductive reactance	B	capacitive reactance is equal to the negative of inductive reactance
	C	capacitive reactance is equal to one	D	inductive reactance is equal to one
19.	In case of purely inductive circuit, average power = ____ and $\theta$ = ____			
	A	1, $90^\circ$	B	1, $0^\circ$
	C	0, $90^\circ$	D	0, $0^\circ$
20.	Determine the average power delivered to the circuit consisting of an impedance $Z = 5+j8$ when the current flowing through the circuit is $I = 5\angle 30^\circ$ .			
	A	62.5	B	61.6
	C	63.5	D	65.5
21.	If power factor = 1, then the current to the load is _____ with the voltage across it.			
	A	$90^\circ$ out of phase	B	out of phase
	C	$45^\circ$ out of phase	D	in phase
22.	The roots of the polynomial $H(z)$ are ----- to the roots of the polynomial $H(Z^{-1})$ .			
	A	identical	B	inverse
	C	opposite	D	double
23.	With a proportional-plus-integral controller, a sustained error will result in:			
	A	A fixed offset	B	A temporary narrowing of the proportional band
	C	A delay in the process	D	Windup

24.	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
25.	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
26.	Maximum line length with RS-488 interface standards is			
	A	15 m	B	1000 m
	C	1200 m	D	3000 m
27	In venture type of flow meter, area of restriction is			
	A	fixed	B	variable
	C	Dynamically changing	D	Not needed
28	A discrete-time LTI system is BIBO stable if its impulse response is			
	A	Not summable	B	zero
	C	Absolutely summable	D	infinite
29	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 Ic and IB
30	Rosette is directly used to measure			
	A	temperature	B	flow
	C	pressure	D	level
31	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	$\frac{1}{z - \frac{1}{2}}; ROC \text{ is }  z  > \frac{1}{2}$

32	The HART protocol is _____ with 4–20 mA equipment			
	A	backward compatible	B	Not backward compatible
	C	Either A or B	D	None of these
33	HART protocol uses			
	A	FSK modulation	B	PSK modulation
	C	ASK modulation	D	None of these
34	Which one is active transducer			
	A	RTD	B	LVDT
	C	Strain gauge	D	thermocouple
35	Which flow meter does not requires external pipe tapping to measure pressure			
	A	Magnetic flow meter	B	Orifice meter
	C	Venturi meter	D	Rota meter
36	Pressure loss in venturi meter is _____ compared to orifice meter			
	A	less	B	high
	C	Either less or high	D	Neither less nor high
37	For high speed application , DACs uses			
	A	Successive approximation form of conversion	B	Parallel form of conversion
	C	Feed forward form of conversion	D	Serial form of conversion
38	When magnetic flow meter is used to measure flow, fluid must be			
	A	Non conductive	B	conductive
	C	corrosive	D	Non corrosive
39	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
40	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

41	Which of the following can be measured by using Hall's effect?			
	A	Magnetic field intensity	B	Carrier concentration
	C	Average number of holes	D	Electrostatic field intensity
42	Compensation in pneumatic control system is provided by			
	A	Restriction - volume combinations	B	Extension tube
	C	Bimetal strip	D	compressor
43	In case of strain gauge , the gauge factor 'K' is related to Poisson's ration $\mu$ by the relation			
	A	$K=1-\mu$	B	$K=1-2\mu$
	C	$\mu=(K-1)/2$	D	$\mu=(K+1)/2$
44	Compared to differential pressure type flow meters, with magnetic flow meters, pressure drop is			
	A	maximum	B	minimum
	C	Either maximum or minimum	D	No pressure drop
45	Negative feedback in an amplifier results in			
	A	Reduced gain but increases bandwidth	B	Reduced gain and bandwidth
	C	increase gain and increases bandwidth	D	Increase gain but Reduced bandwidth
46	..... can be extended to systems which are non linear			
	A	Laplace transform	B	Nyquist criterion
	C	State variable analysis	D	Eigen value analysis
47	Energy of the signal $nu[n]$ is			
	A	$n / 2$	B	$n! / 2$
	C	infinite	D	None of these
48	For strain gauge the gauge factor is generally in the range			
	A	1.5 to 2.0	B	0.5 to 2.0
	C	0.8 to 1.5	D	0.2 to 0.8

49	Which of the following are the starting points of root locus			
	A	Closed loop poles	B	Open loop poles
	C	Closed loop zeros	D	Open loop zeros
50	Principal of paramagnetic effect is used in			
	A	Hydrogen analyzers	B	PH meters
	C	Oxygen analyzers	D	Carbon dioxide analyzers
51	Electrolytic hygrometers are used for			
	A	Moisture analysis	B	Hydrogen analysis
	C	Oxygen analysis	D	None of these
52	The unit of electrolytic conductivity is			
	A	Micro mho/cm	B	Cm/micro mho
	C	Micro ohm/cm	D	Cm/micro ohm
53	A transfer function which has one or more zeros in the RHS of s-plane is known as ..... transfer function			
	A	All phase	B	Maximum phase
	C	Minimum phase	D	Non minimum phase
54	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
55	FIR digital filter have			
	A	Recursive response	B	Non recursive response
	C	Random response	D	None of these
56	Ratio of maximum controllable flow to the minimum controllable flow defines			
	A	Valve capacity	B	Valve rangeability
	C	Valve linearity	D	Valve pressure
57	A control valve which produces flow directly proportional to valve lift , having			
	A	Linear characteristic	B	Non Linear characteristic
	C	Equal percentage characteristic	D	Quick opening characteristic

58	Which type of valve characteristic is primarily used in self-actuated control valves or in regulators			
	A	Linear characteristic	B	Non Linear characteristic
	C	Equal percentage characteristic	D	Quick opening characteristic
59	Polar plots for negative and positive frequencies			
	A	Are always symmetrical	B	May or may not be symmetrical
	C	Can never be symmetrical	D	None of these
60	The principle of pirani gauge is based on .....of the medium			
	A	Thermal conductivity	B	combustibility
	C	humidity	D	turbidity
61	.....is used to measure flow of air around aeroplane?			
	A	Venturi meter	B	anemometer
	C	orifice	D	rotameter
62	Which of the following is determined by hydrometer?			
	A	Specific gravity of liquids	B	Specific gravity of solids
	C	Specific gravity of gases	D	Relative humidity
63	Which of the following is an analogue transducer?			
	A	LVDT	B	Strain gauge
	C	thermocouple	D	All of these
64	....is a low cost thermocouple			
	A	Iron-constantan	B	Tungsten-rhenium
	C	chromel-constantan	D	Platinum-rhodium
65	Which of the following system is generally preferred?			
	A	Under damped	B	Over damped
	C	Oscillatory	D	Critically damped



66	Fieldbus is a....			
	A	Bus to transfer field electrical current	B	Protocol for two way digital transmission of measuring and control signals
	C	Device which can transmit digital data on bus for measuring and control signal	D	Programmable logic controller for controlling plants
67	In case of second order system, the resonance peak will occur when system gain is at the .....damping value			
	A	Under damping	B	Over damping
	C	Critical damping	D	None of these
68	Reciprocal of permeability is			
	A	reluctivity	B	susceptibility
	C	permittivity	D	conductance
69	In a laminar flow through a pipe the discharge varies linearly as its			
	A	Pressure drop	B	viscosity
	C	radius	D	Any of these
70	Thermistors have ..... Temperature coefficient.			
	A	High and negative	B	Low and positive
	C	Low and negative	D	High and positive
71	In 8051 microcontroller, What is the address range of SFR Register bank?			
	A	00H-77H	B	40H-80H
	C	80H-7FH	D	80H-FFH
72	If the time constant of the secondary loop is greater than the time constant of the primary loop, cascade control will:			
	A	Lengthen the period of the total system	B	Improve the operation of the system
	C	Shorten the period of the total system	D	Provide no benefits
73	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

74	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
75	The number of flip flops required in a decade counter is			
	A	2	B	4
	C	8	D	16
76	The principle of operation of LVDT is based on the variation of			
	A	Self inductance	B	Mutual inductance
	C	Reluctance	D	Permanence
77	What is the step size of the 12bit ADC for the full scale measurement range 0 to 10 volts?			
	A	2.44 mv	B	1.20 mv
	C	2.56 mv	D	4.09mv
78	IIR digital filter have			
	A	Random response	B	Non recursive response
	C	Recursive response	D	None of these
79	For the system given by difference equation $y(n)=y(n-1)+x(n)- x(n-8)$			
	A	FIR	B	IIR
	C	Can be both FIR and IIR	D	None of these
80	An ionization gauge is used to measure			
	A	temperature	B	flow
	C	pressure	D	level
81	$\lim_{x \rightarrow \frac{\pi}{2}} \frac{\sin(x \cos x)}{\cos(x \sin x)} = \dots\dots\dots$			
	A	$\frac{2}{\pi}$	B	$\frac{\pi}{2}$
	C	does not exist	D	none of these
82	The function $f(x, y) = 2x^2 - 2y^2 - x^4 + y^4$ has saddle point at .....			
	A	(1, 1)	B	(1, 0)
	C	(0, 2)	D	(0, 0)

83	Which of the following methods is not a direct method for solving a system of simultaneous linear equations?			
	A	Cramer's	B	Gauss-Jordan
	C	relaxation	D	Gauss elimination
84	If $A = \begin{bmatrix} 3 & 0 \\ 8 & -1 \end{bmatrix}$ then the eigen values of $A+3I$ are....., where $I$ is a $2 \times 2$ identity matrix.			
	A	$3, -1$	B	$6, 2$
	C	$-3, -1$	D	$-3, 1$
85	Laplace transform of unit step function $u(t-a)$ is			
	A	$\frac{e^{-as}}{s^2}$	B	$\frac{e^{-as}}{s}$
	C	$\frac{1}{s}$	D	$\frac{e^{as}}{s}$
86	Inverse Laplace transform of $\frac{1}{s^2 - \omega^2}$ is			
	A	$\frac{1}{\omega} \sin \omega t$	B	$\sin \omega t$
	C	$\frac{1}{\omega} \sinh \omega t$	D	$\sinh \omega t$
87	Which of following complex function is not differentiable?			
	A	$z^2$	B	$\sin z$
	C	$\bar{z}$	D	none of these
88	A bounded entire function is constant. This is stated in .....theorem.			
	A	Cauchy's integral	B	Morera's
	C	Cauchy's residue	D	Liouville's
89	$\oint_c \frac{dz}{z} = \underline{\hspace{2cm}}$ , where $c$ is a unit circle			
	A	$2\pi i$	B	$3\pi i$
	C	$4\pi i$	D	$\pi i$
90	The system of linear equations $x - 2y + z = 4$ , $3x + 5y + z = 6$ , $6x - y + 4z = 2$ has			
	A	no solution	B	infinitely many solutions
	C	a unique solution	D	two solutions

91	If $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ then $\text{div } \vec{r} = \dots$			
	A	3	B	$\vec{r}$
	C	$x + y + z$	D	none of these
92	If a vector field $\vec{F}$ is conservative and curve C is closed then $\oint_C \vec{F} \cdot d\vec{r} = \dots\dots$			
	A	0	B	0
	C	non zero value	D	vector function
93	Which of the following methods does not require prior information about the approximate value?			
	A	bisection method	B	False position method
	C	Newton-Raphson method	D	Root squaring method
94	Which of the following methods is one of the predictor-corrector methods to solve first order linear differential equation numerically?			
	A	Milne's method	B	Picard's method
	C	Runge-Kutta fourth order method	D	Taylor's series method
95	In which distribution mean, median and mode coincide?			
	A	Binomial	B	Exponential
	C	Poisson	D	Normal
96	If $y = e^{-x}$ is one of the solutions of $\frac{d^2 y}{dx^2} + 2\frac{dy}{dx} + y = 0$ then the second solution is given by			
	A	$x^2 e^{-x}$	B	$x e^{-x}$
	C	$x^2 e^x$	D	$x e^x$
97	Consider the probability function $p(x) = \frac{6 -  x - 7 }{36}$ for $x = 2, 3, 4, \dots, 12$ . What is $p(6 < x \leq 8)$ ?			
	A	$\frac{16}{36}$	B	$\frac{6}{36}$
	C	$\frac{5}{36}$	D	none of these
98	Which of the following is a Cauchy's homogeneous linear second order differential equation?			
	A	$\frac{d^2 y}{dx^2} - 3\frac{dy}{dx} + 2y = 3x + 2$	B	$(3x + 2)^2 \frac{d^2 y}{dx^2} + 5(3x + 2)\frac{dy}{dx} - 3y = 0$
	C	$x^2 \frac{d^2 y}{dx^2} - 3x\frac{dy}{dx} + 3y = 3\log x + 2$	D	none of these

99	The formula of numerical integration obtained from Newton-Cotes' quadrature formula by putting $n = 6$ is known as .....			
	A	Simpson's one-third rule	B	Weddle's rule
	C	Simpson's three-eighth rule	D	Gaussian quadrature formula
100	$\frac{dy}{dx} = \frac{y}{x}$ is ...			
	A	Separable but not Linear	B	Linear but not separable
	C	Separable but not homogeneous	D	both Linear and separable