

This Question Booklet contains
12 printed pages

PGIC

A
Seal Sticker

Total Marks : 100
Time : 100 Minutes

Question
Booklet
Code :

A

Candidate's
Seat No. :

Candidate's Signature _____ Block Supervisor's Signature _____

DO NOT OPEN QUESTION BOOKLET UNTIL INSTRUCTED.

INSTRUCTIONS FOR CANDIDATE:

1. Check Number printed on your OMR SHEET and Question Paper with your SEAT No. before answering the questions. Consult block supervisors in case the above mentioned numbers do not match with your seat number.
2. There are total 100 questions. For answer of each question A, B, C, D, E options are given in OMR SHEET. In OMR SHEET, there is "E" option. "E" option is for "Not Attempted". If candidate do not wish to answer the question he/she should select "E" option (Not Attempted). All questions are compulsory.

For Example:

Which state of India has the longest sea shore ?

A ☐ B ☐ C ☒ D ☐ E ☐

(A) Maharashtra (B) Tamilnadu
(C) Gujarat (D) Andhra Pradesh

In this example, the right answer is (C). Therefore, the Circle of (C) has been darkened (encoded). Candidate should not give the answer "Gujarat" in writing.

The options once darkened/answered by candidate cannot be changed.

3. Candidates are not permitted to leave examination hall during examination.
4. Candidates must strictly enter SEAT NO. in the designated space provided in OMR SHEET as well as Question Paper neatly as soon as they receive the OMR SHEET & Question Paper.
5. Candidates must not write name or put any identification sign/symbol on OMR SHEET. In such case strict disciplinary action will be taken against candidate & will be considered disqualified/ineligible. Only Seat No. must be

entered at designated space provided in OMR SHEET.

6. Both, Candidate's & Supervisor's signature must be done on Certificate of OMR SHEET. Unsigned OMR SHEET would not be considered for evaluation.
7. Candidates are not permitted to use or carry with them any kind of literature, guide, hand written notes, or printed books, mobile phone, pagers, smart watches, camera or any electronic gadgets to examination hall.
8. Use of only Non-scientific / Non-programmable calculator shall allow during examination.
9. Candidates are not permitted to talk/discuss in the Examination Hall. Any candidate found violating supervisor's instructions will be disqualified.
10. Candidates must fully darken circle A, B, C, D and E accordingly with Blue / Black ball pen. If answers are marked with any other coloured ball pen, pencil, white ink (whitner), any corrections are done by candidate by means of blade or rubber or whitner will not be considered for evaluation.
11. Candidates may carry QP with them after Examination.
12. **For correct answer 1 (One) marks will be given.**

If candidate gives more than one option as answer for one question in answer sheet (OMR SHEET), or gives wrong answer then the candidate will be allotted Zero (0) marks.

If candidate does not want to answer a particular question and marks (E) or leave the option without encoding on OMR sheet, then no minus marks will be given.

Submit the OMR SHEET to the block supervisor after completion of examination without fail before leaving examination hall, failure to do so will result in disqualification of the candidature for the examination and disciplinary action will be taken against such candidate.

1. The open-loop transfer function of a feedback control system is given below:

$$G(s)H(s) = \frac{K}{s(s+10)}$$

The value of gain factor K for critical damping is

- (A) 35 (B) 20
(C) 15 (D) 25
2. A unity feedback system having transfer function, $G(s) = \frac{100}{s(0.1s+1)}$ is subjected to unit ramp input. The steady State error will be
(A) 1 (B) 0.01
(C) 0 (D) 0.05
3. 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) $K = 48$ (B) $K = 24$
(C) $K = 6$ (D) $K = 4$
4. The initial slope of the Bode plot for a type 2 system intersects 0db axis at
(A) $\omega = 0$ (B) $\omega = K$
(C) $\omega = \sqrt{K}$ (D) $\omega = K^2$
5. If Maximum overshoot $M_p = 100\%$, the damping ratio is
(A) 0 (B) 1
(C) Infinity (D) 0.5
6. Process degrees of freedom
(A) indicates the maximum number of controllers to be used.
(B) indicates the minimum number of controllers to be used.
(C) determines both maximum and minimum number of controllers to be used.
(D) gives no idea of controllers.
7. Cascade control means
(A) feed forward control (B) on-off control
(C) more than one feedback loop (D) one feedback loop
8. P-I controller as compared to P controller has a
(A) higher maximum deviation (B) longer response time
(C) longer period of oscillation (D) all (A), (B), (C)
9. A good control system should be sensitive to
(A) Input signals (B) Internal disturbances
(C) Parametric variations (D) Environmental parameters
10. In a PLC, the scan time refers to the amount of time in which
(A) the technician enter the program
(B) timers and counters are indexed
(C) one rung of ladder logic takes to complete
(D) the entire program takes to execute

11. What is the frequency range of ECG signal?
 (A) 70-120 Hz (B) 0.05-120 Hz
 (C) 5-120 Hz (D) 12-120 Hz
12. What is the signal amplitude of EEG signal?
 (A) 2-200 μV (B) 2-200 mV
 (C) 2-2000 μV (D) 2-2000 mV
13. Emission Spectroscopy is used for
 (A) Determination of CO_2 in gases (B) Determining water purity
 (C) Solid and metal analysis (D) NO_x determination
14. In magnetic deflection mass spectrometer in which of the following ways is acceleration applied to the direction of motion?
 (A) Perpendicular to it (B) Parallel to it
 (C) In random manner (D) Along it
15. Which of the following happens to the magnetic susceptibility of gases when the temperature changes?
 (A) It increases with increase in temperature.
 (B) It remains constant with increase in temperature.
 (C) It remains constant with decrease in temperature.
 (D) It decreases with increase in temperature.
16. The minimum input of physical parameter that will create a detectable output change is called
 (A) Sensitivity (B) Threshold
 (C) Span (D) Precision
17. The undesirable characteristics of a measuring system is
 (A) Drift (B) Non Linearity
 (C) Dead zone (D) All of these
18. In a LVDT, the two secondary voltages
 (A) are always in phase quadrature
 (B) are independent of core position
 (C) vary unequally depending on the core position
 (D) vary equally depending on the core position
19. A pressure instrument is calibrated from 100 to 600 psi. The span of this instrument is
 (A) 600 (B) 500
 (C) 100 (D) 400
20. The principle of Pirani Gauge is based on
 (A) thermal conductivity of the medium (B) humidity of the medium
 (C) combustibility of the medium (D) none of these
21. The transient currents are due to
 (A) impedance of the circuit
 (B) changes in stored energy in inductors and capacitors
 (C) resistance of the circuit
 (D) voltage applied to the circuit

22. When two 2-port networks are connected in parallel, it is convenient to use parameters.
 (A) inverse hybrid (B) open-circuit impedance
 (C) short-circuit admittance (D) transmission
23. A capacitor C at time $t = 0^+$ with zero initial charge act as a
 (A) voltage source (B) current source
 (C) short-circuit (D) open-circuit
24. An inductor at $t = \infty$ with zero initial current acts as
 (A) open circuit (B) short-circuit
 (C) voltage source (D) current source
25. The double integration of a unit step function results in a unit
 (A) parabola (B) impulse
 (C) ramp function (D) doublet
26. Which semiconductor device behaves like two SCRs ?
 (A) MOSFET (B) JFET
 (C) UJT (D) Triac
27. The highest voltage gain can be obtained from which of the following?
 (A) CB configuration (B) CC configuration
 (C) CE configuration (D) Any of the above
28. The purpose of coupling capacitor in an amplifier is to
 (A) control the output
 (B) match the impedance
 (C) control the bandwidth
 (D) prevent D.C. mixing with input
29. The noise factor for an ideal noise free transistor amplifier is
 (A) zero dB (B) 1 dB
 (C) zero (D) none of these
30. An oscillator produces oscillations due to
 (A) negative feedback
 (B) positive feedback
 (C) partially positive and partially negative feedback
 (D) neither positive nor negative feedback
31. A Mcleod gauge can measure pressure as low as
 (A) 0.05 torr (B) 0.005 torr
 (C) 0.0005 torr (D) 0.00005 torr
32. A type J thermocouple is made of the following metals.
 (A) Aluminum & Tungsten (B) Platinum & Rhodium
 (C) Iron & constantan (D) Chromel & Alumel
33. On addition of -46 and $+28$ using 2's complement, we get
 (A) -10010 (B) -00101
 (C) 01011 (D) 0100101

34. The decimal number 10 is represented in its BCD form as
 (A) 10100000 (B) 01010111
 (C) 00010000 (D) 00101011
35. How many select lines would be required for an 8-line-to-1-line multiplexer?
 (A) 2 (B) 4
 (C) 8 (D) 3
36. The enable input in digital circuits is also known as
 (A) Select input (B) Decoded input
 (C) Strobe (D) Sink
37. A counter circuit is usually constructed of
 (A) A number of latches connected in cascade form
 (B) A number of NAND gates connected in cascade form
 (C) A number of flip-flops connected in cascade form
 (D) A number of NOR gates connected in cascade form
38. Functional element of smart transmitter are:
 (A) ADCs (B) DACs
 (C) Microprocessor (D) ADC, DAC, Microprocessor
39. An ionization gauge is used to measure
 (A) temperature (B) flow
 (C) pressure (D) level
40. If the proportional band of the controller is adjusted to minimum possible value, the control action is likely to be:
 (A) Excellent (B) With maximum offset
 (C) In operative (D) On / Off
41. The function of the integral(reset) mode in PID control is to:
 (A) Automatically adjust the controller's gain.
 (B) Eliminate offset.
 (C) Stabilize the control loop.
 (D) Oppose change in measurement.
42. With reference to proportional controller, gain and proportional band are
 (A) adjusted independently of one another.
 (B) reciprocally related.
 (C) two different control mode.
 (D) controller functions calibrated in time units.
43. 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
44. If $x(-t) = x(t)$, a signal $x(t)$ is referred to as
 (A) Even signal (B) Even and Odd signal
 (C) Odd Signal (D) None of these

45. 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
46. In Ventury type of flow meter, area of restriction is
 (A) fixed (B) variable
 (C) dynamically changing (D) not needed
47. A discrete time LTI system is BIBO stable if its impulse response is
 (A) not summable (B) zero
 (C) absolutely summable (D) infinite
48. Which stage of DC power supply uses a Zener diode as the main component?
 (A) regulator (B) filter
 (C) rectifier (D) voltage divider
49. Maximum line length with RS-232C interface standards is
 (A) 15 m (B) 150 m
 (C) 1500 m (D) 3000 m
50. Rosette is directly used to measure
 (A) temperature (B) flow
 (C) pressure (D) level
51. The period of the signal $x(t) = 5\sin 5t - 7\cos 7t$ is
 (A) π (B) 35π
 (C) 70π (D) 2π
52. HART protocol uses
 (A) FSK modulation (B) PSK modulation
 (C) ASK modulation (D) None of these
53. Which one is active transducer
 (A) RTD (B) LVDT
 (C) Strain gauge (D) Thermocouple
54. In a sequential circuit, the output state depends on
 (A) input states only
 (B) past output states and present input states
 (C) input and output states
 (D) none of these
55. Which flow meter does not requires external pipe tapings to measure pressure?
 (A) Magnetic flow meter (B) Orifice meter
 (C) Venturi meter (D) Rota meter
56. Pressure loss in Venturi meter is _____ compared to orifice meter:
 (A) Less (B) High
 (C) Either less or high (D) Neither less nor high

57. Since input resistance of an Ideal OP-Amp is infinite:
- (A) Its input current is zero
 - (B) Its output resistance is zero
 - (C) Its output voltage becomes independent of load resistance
 - (D) It becomes a current controlled device
58. For high speed application, DACs uses
- (A) Feed forward form of conversion
 - (B) Parallel form of conversion
 - (C) Successive approximation form of conversion
 - (D) Serial form of conversion
59. 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
60. The number of flipflops required in a decade counter is
- (A) 2
 - (B) 4
 - (C) 8
 - (D) 16
61. The period of the signal $x[n] = u(n-1) - u(n-7)$ is
- (A) 1
 - (B) 6
 - (C) 7
 - (D) Not periodic
62. In case of strain gauge, the gauge factor 'K' is related to Poisson's ratio ' μ ' by the relation
- (A) $K = 1 - \mu$
 - (B) $K = 1 - 2\mu$
 - (C) $\mu = (K - 1)/2$
 - (D) $\mu = (K + 1)/2$
63. Compared to differential pressure type flow meters, the magnetic flow meters, pressure drop is
- (A) Maximum
 - (B) Minimum
 - (C) Either maximum or minimum
 - (D) No pressure drop
64. Energy of the signal $nu[n]$ is
- (A) $n / 2$
 - (B) $n! / 2$
 - (C) Infinite
 - (D) None of these
65. Feedback control systems are basically
- (A) Low pass filter
 - (B) High pass filter
 - (C) Band pass filter
 - (D) Band stop filter
66. LVDT works on the principle of
- (A) Variable Resistance
 - (B) Variable Inductance
 - (C) Variable Capacitance
 - (D) Variable Pressure
67. With reference to following characteristic equation of a feedback control system. The centroid of the root locus plot is
- $$S^3 + 2s^2 + KS + K = 0$$
- (A) 0.5
 - (B) -0.5
 - (C) -1
 - (D) 1

68. With reference to frequency response, resonance peak occurs only if the Value of damping ratio is
 (A) equals to 1 (B) 0.707
 (C) 0.5 (D) 1.41
69. The Bode plot approach is applicable to
 (A) non-minimum phase network (B) minimum phase network
 (C) any network (D) none of these
70. The overall transfer function of a control system is given below

$$\frac{C(s)}{R(s)} = \frac{25}{s^2 + 5\sqrt{2}s + 25}$$

 The resonant peak M_r is
 (A) 0.5 (B) $\sqrt{2}$
 (C) 2 (D) 1.0
71. The inverse Laplace transform of

$$X(s) = \frac{2}{s^2 + 2s + 5}$$
 is
 (A) $X(t) = e^{-t} \cos 2t$ (B) $X(t) = e^{-t} \sin 2t$
 (C) $X(t) = e^{-2t} \cos 5t$ (D) $X(t) = e^{-2t} \sin 5t$
72. If the signal $x(t)$ has odd and half wave symmetry, then the Fourier series will have only
 (A) odd harmonics of sine terms
 (B) constant term and odd harmonics of cosine terms
 (C) even harmonics of cosine terms
 (D) odd harmonics of cosine terms
73. The transfer function of a continuous time system is given by

$$\frac{Y(s)}{X(s)} = \frac{s^4 + 4s + 3}{s^5 + 4s^3 + 1}$$

 The number of state variable in the state model of the system is
 (A) 1 (B) 5
 (C) 4 (D) 2
74. The zero input response (or) natural response is mainly due to,
 (A) Initial stored energy in the system (B) Initial conditions in the system
 (C) Specific input signal (D) specific output signal
75. The ROC of the sequence $x(n) = u(-n)$ is
 (A) $|Z| > 1$ (B) $|Z| < 1$
 (C) no ROC (D) $-1 < |Z| < 1$
76. The Z-transform is a
 (A) finite series (B) infinite power series
 (C) geometric series (D) both finite and infinite power series
77. The ROC of the signal $x(n) = a^n$ for $-5 < n < 5$ is
 (A) Entire Z-plane (B) Entire Z-plane except $Z = 0$ and $z = \infty$
 (C) Entire Z-plane except $Z = 0$ (D) Entire Z-plane except $Z = \infty$

78. Which of the following valves cause the greatest head loss when completely open
 (A) Ball valve (B) Butterfly valve
 (C) Gate valve (D) Globe valve
79. Electromechanically operated valve is
 (A) Solenoid valve (B) Pilot valve
 (C) Port valve (D) Check valve
80. In OR function implemented in PLC for ladder logic uses
 (A) normally closed contacts in series (B) normally open contacts in series
 (C) normally open contacts in parallel (D) normally closed contacts in parallel
81. The eigen values of the following matrix

$$\begin{bmatrix} 10 & -4 \\ 18 & -12 \end{bmatrix}$$

 (A) 4, 9 (B) 6, -8
 (C) 4, 8 (D) -6, 8
82. The value of $\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n$ is
 (A) $\ln 2$ (B) 1.0
 (C) e (D) ∞
83. A box contains 25 parts of which 10 are defective. Two parts are being drawn simultaneously in a random manner from the box. The Probability of both the parts being good is
 (A) 7/20 (B) 42/125
 (C) 25/29 (D) 5/9
84. Which one of the following is first order linear differential equation
 (A) $\frac{dy}{dx} + xy = e^{-x}$ (B) $\frac{dy}{dx} + xy = e^{-y}$
 (C) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = 0$ (D) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + y = \cos x$
85. The value of $\oint_c \frac{\sin z}{z} dz$, where the contour of the integration is a simple closed curve around the origin is
 (A) 0 (B) $2\pi i$
 (C) ∞ (D) $1/2\pi i$
86. The Newton - Raphson iteration $x_{n+1} = \frac{1}{2} \left(x_n + \frac{N}{x_n} \right)$ can be used to compute
 (A) square root of N (B) reciprocal of N
 (C) Square of N (D) logarithm of N

87. Given a system of equations

$$x + 2y + 2z = b_1$$

$$5x + y + 3z = b_2$$

Which of the following is true its solutions ?

- (A) The system has unique solution for any given values of b_1 & b_2
- (B) The system will have infinitely many solution for any values of b_1 & b_2
- (C) Whether or not a solution exists depends on given b_1 & b_2
- (D) The system would have no solution for any values of b_1 & b_2

88. The total derivative of the function xy is

- (A) $x dy + y dx$
- (B) $x dx + y dy$
- (C) $dx + dy$
- (D) $dx dy$

89. Consider a poisson distribution for the tossing of a biased coin. The mean for this distribution is μ . The standard deviation for this distribution is given by

- (A) $\sqrt{\mu}$
- (B) μ^2
- (C) μ
- (D) $1/\mu$

90. The solution of the initial Value problem $\frac{dy}{dx} = 2xy; y(0) = 2$ is

- (A) $1 + e^{-x^2}$
- (B) $2e^{-x^2}$
- (C) $1 + e^{x^2}$
- (D) $2e^{x^2}$

91. $\oint \frac{z^2}{z^2 - 1} dz$ in the counterclock wise $|z - 1| = 1$ direction around $|z - 1| = 1$ is

- (A) $-\pi i$
- (B) 0
- (C) πi
- (D) $2\pi i$

92. Numerical integration using trapezoidal rule gives the best result for a single variable function which is

- (A) Linear
- (B) parabolic
- (C) logarithmic
- (D) hyperbolic

93. Using Euler method Find $y(0.3)$, for $\frac{dy}{dx} = 2xy + 1; y(0) = 0$ with step size $h = 0.1$

- (A) 0.3101
- (B) 0.3142
- (C) 0.6202
- (D) 4.0800

94. For the function $\frac{\sin z}{z^3}$ of a complex variable Z , the point $Z = 0$ is

- (A) a pole of order 3
- (B) a pole of order 2
- (C) a pole of order 1
- (D) not a singularity

95. Laplace transform of $\cos wt = \frac{s}{s^2 + w^2}$ Then Laplace transform of $e^{-2t} \cos 4t$ is
- (A) $(S-2) / (S-2)^2 + 16$ (B) $(S+2) / (S-2)^2 + 16$
 (C) $(S-2) / (S+2)^2 + 16$ (D) $(S+2) / (S+2)^2 + 16$
96. Consider the data set 14, 18, 14, 14, 10, 29, 33, 31, 25. If you add 20 to each of the values then
- (A) both mean and Variance change
 (B) both mean and Variance unchanged
 (C) the mean is unchanged, variance changes
 (D) the mean is changed, the variance is unchanged
97. The function $f(x) = 2x^3 - 3x^2 - 36x + 2$ has its maxima at
- (A) $x = -2$ only (B) $x = 0$ only
 (C) $x = 3$ only (D) both $x = -2$ and $x = 3$
98. The sum of Eigen values of the matrix
- $$A = \begin{bmatrix} 215 & 650 & 795 \\ 655 & 150 & 835 \\ 485 & 355 & 550 \end{bmatrix}$$
- (A) 915 (B) 1355
 (C) 1640 (D) 2180
99. Divergence of the vector field $x^2 z \bar{i} + xy \bar{j} - yz^2 \bar{k}$ at $(1, -1, 1)$ is
- (A) 0 (B) 3
 (C) 5 (D) 6
100. The partial differential equation $\frac{\partial y}{\partial t} = \infty \frac{\partial^2 y}{\partial x^2}$ where ∞ is a positive constant, is
- (A) Circular (B) Parabolic
 (C) Elliptic (D) Hyperbolic

