A
SET

Booklet No. :

EI - 15

Instrumentation Engineering

Duration of Test : 2 Hours **Max. Marks : 120**

Hall Ticket No. | | | | | | | | |

Name of the Candidate : _____

Date of Examination : _____ **OMR Answer Sheet No. :** _____

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INSTRUCTIONS

1. This Question Booklet consists of **120** multiple choice objective type questions to be answered in **120** minutes.
2. Every question in this booklet has 4 choices marked (A), (B), (C) and (D) for its answer.
3. Each question carries **one** mark. There are no negative marks for wrong answers.
4. This Booklet consists of **16** pages. Any discrepancy or any defect is found, the same may be informed to the Invigilator for replacement of Booklet.
5. Answer all the questions on the OMR Answer Sheet using **Blue/Black ball point pen only.**
6. Before answering the questions on the OMR Answer Sheet, please read the instructions printed on the OMR sheet carefully.
7. OMR Answer Sheet should be handed over to the Invigilator before leaving the Examination Hall.
8. Calculators, Pagers, Mobile Phones, etc., are not allowed into the Examination Hall.
9. No part of the Booklet should be detached under any circumstances.
10. The seal of the Booklet should be opened only after signal/bell is given.

INSTRUMENTATION ENGINEERING (EI)

1. The set of the equations $x+y+z=3$, $x+2y+3z=4$ and $x+4y+9z=6$ has

(A) unique solution (B) trivial solution

(C) many solutions (D) no solution

2. The three eigen values of the matrix $\begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$ are

(A) 0, 0, 3 (B) 1, 2, 3 (C) 1, –i, i (D) 2, 2, 2

3. If $f(x)$ is an odd function in the interval (–L, L), then the Fourier coefficient a_n is

(A) 1 (B) does not exist (C) 0 (D) equal to b_n

4. If F is a conservative force field, then there exist a scalar function ϕ

(A) $\nabla.F = 0$ (B) $F = \nabla^2\phi$ (C) $F = \nabla\phi$ (D) none

5. The particular integral $\frac{1}{(D-2)^2}\sin 2x$ is

(A) $\frac{1}{4}\sin 2x$ (B) $\frac{x}{2}\cos 2x$ (C) $\frac{1}{4}\cos 2x$ (D) none

6. The complete integral of $\sqrt{p}+\sqrt{q}=1$ is

(A) $z=ax+by+c$ (B) $z=\sqrt{x}+\sqrt{y}+c$

(C) $z = ax + (1-\sqrt{a})^2y + c$ (D) $z=ax+(1-\sqrt{a})y+c$

7. If $f(z)=\frac{z}{(z+1)(z+2)}$ then the residue of $f(z)$ at $z=-2$ is

(A) 0 (B) 2 (C) 1 (D) –2

8. The variance of the random variable whose probability distribution function $f(x)=\frac{e^{-\lambda}\lambda x}{x!}$, $\lambda \geq 0$ is

(A) λ^2 (B) $\frac{1}{\lambda}$ (C) λ (D) 1

9. The minimum and maximum values of the coefficient of correlation are

(A) –1 and 1 (B) 0 and 1 (C) –1 and 0 (D) –2 and 2

10. For the initial value problem $\frac{dy}{dx} = x + y + xy$ and $y(0) = 1$, then the value of $y(0.025)$ by Euler's method is

(A) 0.025 (B) 1.05 (C) 1.025 (D) none

11. The energy stored in the magnetic field at a solenoid 30 cm long and 3 cm diameter wound with 1000 turns of wire carrying a current of 10 A is

(A) 0.015 J (B) 0.15 J (C) 0.5 J (D) 1.15 J

12. The root-mean square value of voltage waveform consisting of a super imposition of 2 V dc and a 4 V peak to peak square wave is

(A) 2 V (B) $\sqrt{6}$ V (C) $\sqrt{8}$ V (D) $\sqrt{12}$ V

13. A generator of internal impedance $|Z_G|$ delivers maximum power to a load impedance Z_P only if

(A) $Z_P < Z_G$ (B) $Z_P > Z_G$ (C) $Z_P = Z_G$ (D) $Z_P = 2\,Z_G$

14. A DC voltage source is connected across a series RLC circuit. Under steady condition, the applied DC voltage drops entirely across the

(A) C only (B) R only (C) L only (D) R and L combination

15. The maximum value of mutual inductance of two coils inductively coupled coils with self inductance of $L_1 = 49$ mH and $L_2 = 81$ mH is

(A) 130 mH (B) 3969 mH (C) 32 mH (D) 63 mH

16. The short-circuit admittance matrix of two port network is $\begin{bmatrix} 0 & -1/2 \\ 1/2 & 0 \end{bmatrix}$, the two port network is

(A) non-reciprocal and passive (B) non-reciprocal and active

(C) reciprocal and passive (D) reciprocal and active

17. A circuit which resonates at 1 MHz has a Q of 100. Bandwidth between half-power point is

(A) 10 kHz (B) 100 kHz (C) 10 Hz (D) 100 Hz

18. A pressure gauge is calibrated from 0-50 kN/m^2. It has a uniform scale with 100 scale divisions. One fifth of a scale division can be read with certainty. The gauge has

(A) a resolution of 0.5 kN/m^2 (B) threshold of 0.15 kN/m^2

(C) resolution of 0.1 kN/m^2 (D) dead zone of 0.2 kN/m^2

19. A capacitor is charged by a constant current of 2 mA and results in a voltage increase of 12 V in a 10 sec interval. The value of capacitance is

(A) 0.75 mF (B) 1.33 mF (C) 0.6 mF (D) 1.67 mF

20. The maximum probability has a large value for small value of

(A) standard deviation (B) precision index

(C) uncertainty (D) average deviation

21. In second order system the frequency of damped oscillation is 18 rad /sec. The value of damping factor is 0.866. The natural frequency of oscillation is

(A) 15.6 rad/s (B) 19.3 rad/s (C) 36 rad/s (D) 9 rad/s

22. The transfer function of a system is G(s) = $\frac{100e^{-st}}{S(S+10)}$. The system

(A) has a transportation lag (B) is a non-linear system

(C) is a linear system (D) has a zero dead time

23. According to Chauvenet's criterion, a reading out of a set of n readings should be rejected if the probability of obtaining the deviation from mean is

(A) less than 1/2n (B) greater than 1/2n

(C) less than 1/n (D) less than 1/$\sqrt{2n}$

24. A measurement system with input x(t) and output of y(t) is described by the differential equation is $3\frac{dy}{dt}$ +5y = 8x. The static sensitivity of the system is

(A) 0.60 (B) 1.60 (C) 1.67 (D) 2.67

25. A transducer has an output impedance of 1 kΩ and a load resistance of 1 Ω, then it behaves as

(A) constant power source (B) constant voltage source

(C) constant current source (D) constant impedance source

26. In a transducer, the observed output deviates from the correct value by a constant factor the resulting error is called

(A) dynamic error (B) hysteresis error

(C) non-conformity error (D) sensitivity error

27. A resistance potentiometer has a total resistance of 10 kΩ and is rated 4W. If the range of the potentiometer is 0 to 100 mm, then its sensitivity in V/mm is

(A) 1.0 (B) 2.0 (C) 2.5 (D) 25

28. For signal conditioning of the piezoelectric type transducer, we require

(A) a charge amplifier (B) a differential amplifier

(C) an instrumentation amplifier (D) a transconductance amplifier

29. Two inductive transducers working on the principle of change of self inductance L are connected in a push-pull arrangement. If the change of inductance of transducers is ΔL, the change of inductance of output terminal is

(A) ΔL (B) 2ΔL (C) ± 2ΔL (D) Zero

30. A piezoelectric accelerometer has a sensitivity of 100 mV/g. The transducer is subjected to a constant acceleration of 5 g. The steady state output of the transducer will be

(A) zero (B) 100 mV (C) 0.5 V (D) 5 V

31. Magnetostriction is the effect produced when a magnetic material is subjected to change of magnetization results in change of

(A) permittivity

(B) permeability

(C) dimensions

(D) temperature

32. A barium titanate crystal has a thickness of 2 mm. Its voltage sensitivity is 12×10^{-3} Vm/N. It is subjected to a pressure of 0.5 MN/m^2. Calculate the voltage generated

(A) 3 V (B) 6 V (C) 9 V (D) 12 V

33. Pirani gauge is used for the measurement of pressure in the range of

(A) 10^{-1} mm to 10^{-3} mm of Hg (B) 10^{-1} mm to 10^{-6} mm of Hg

(C) 10^{-1} mm to 10^{-9} mm of Hg (D) 10^{-1} mm to 10^{-12} mm of Hg

34. In a drag cup type a.c. tachogenerator, the output voltage is

(A) sinusoidal (B) in the form of pulses

(C) modulated waveforms (D) constant dc voltage

35. If the temperature of a radiating body is 1500 °C, the wavelength at which the maximum radiant energy occurs is

(A) 2.8 μm (B) 1.63 μm (C) 1 μm (D) 4.5 μm

36. Magnetic flux can be measured by which of the transducers ?

(A) Capacitive pickup (B) Inductive pickup

(C) Piezoelectric pickup (D) Hall effect pickup

37. In a venturimeter the flow rate is 0.15 m^3/s when the differential pressure is 30 kN/m^2. What is the value of flow when the differential pressure is 60 kN/m^2 ?

(A) 0.212 m^3/s (B) 0.106 m^3/s (C) 0.3 m^3/s (D) 0.075 m^3/s

38. A diaphragm has a natural frequency of 30 kHz. If both the diameter and thickness are halved, the natural frequency is

(A) 15 kHz (B) 240 kHz (C) 60 kHz (D) 120 kHz

39. The torque in a rotating shaft is measured using strain gauges. The strain gauges must be positioned on the shaft such that axes of the strain gauges are at

(A) 0° with respect to the axis of the shaft

(B) 30° with respect to the axis of the shaft

(C) 45° with respect to the axis of the shaft

(D) 90° with respect to the axis of the shaft

40. Measurement of viscosity involves measuring

(A) Corioli's forces (B) Buoyant force

(C) Centrifugal force (D) Frictional force

41. The input impedance (Z_i) and the output impedance (Z_o) of an ideal transconductance amplifier are

(A) $Z_i = 0, Z_o = 0$ (B) $Z_i = 0, Z_o = \infty$ (C) $Z_i = \infty, Z_o = 0$ (D) $Z_i = \infty, Z_o = \infty$

42. A forward-biased silicon diode when carrying negligible current, has a voltage drop of 0.64 V. When the current is 1 A it dissipates 1W. The On-resistance of the diode is

(A) 1.0 Ω (B) 0.64 Ω (C) 0.74 Ω (D) 0.36 Ω

43. In a negative feedback amplifier using voltage series feedback

(A) R_i decreases and R_o decreases (B) R_i decreases and R_o increases

(C) R_i increases and R_o decreases (D) R_i increases and R_o increases

44. The first dominant pole encountered in the frequency response of a compensated op-amp is approximately at

(A) 5 Hz (B) 10 kHz (C) 1 MHz (D) 100 MHz

45. An n-type semiconductor strain gauge has a nominal resistance of 1000Ω and gauge factor of –100. The resistance of the gauge, when a compressive strain of 100 μm/m is applied, is

(A) 900 Ω (B) 990 Ω (C) 1100 Ω (D) 1010 Ω

46. A diode whose internal resistance is 10 Ω, is to power supply to 1000 Ω load from 110 V (rms) source supply. Calculate the DC and AC load currents

(A) 49.02 mA, 77 mA (B) 77 mA, 49.02 mA

(C) 77 A, 49.02 A (D) 49.02 A, 77 A

47. An audio amplifier is designed to have a small-signal bandwidth of 20 kHz. The open-loop low-frequency voltage gain of the op-amp is 10^5 and unity gain bandwidth is 1 MHz. What is the maximum closed-loop voltage gain for this amplifier ?

(A) 500 (B) 5×10^6 (C) 2×10^6 (D) 50

48. An ideal op-amp has the characteristics of an ideal

(A) voltage controlled voltage source (B) voltage controlled current source

(C) current controlled voltage source (D) current controlled current source

49. A 1^{st} order low-pass Butter-Worth filter has a cut-off frequency of 1 kHz for C = 0.01 μF. Now, if the cut-off frequency has to change by a scaling factor of 0.625.What should be the value of resistor ?

(A) 15.9 kΩ (B) 25.44 kΩ (C) 9.95 kΩ (D) 25.47 kΩ

50. Three identical amplifiers with each one having a voltage gain of 50, input resistance of 1 kΩ and output resistance of 250 Ω are cascaded. The open circuit voltage gain of the combined amplifier is

(A) 49 dB (B) 51 dB (C) 98 dB (D) 102 dB

51. A class B push-pull complementary symmetry amplifier uses

(A) two npn transistors

(B) one pnp and one npn transistor

(C) two pnp transistors

(D) one pre-amplifier of npn transistor followed by amplifier of two transistor

52. A unity gain buffer amplifier has a bandwidth of 1 MHz. The output voltage of the amplifier for an input of 2 V sinusoid of frequency 1 MHz will be

(A) 2 V (B) $2\sqrt{2}$ V (C) $\frac{2}{\sqrt{2}}$ V (D) $\frac{4}{\sqrt{2}}$ V

53. The output of an op-amplifier is 2V peak. The slew rate is 5 V/μs. The input sinusoidal which can be reproduced with no distortion has the maximum frequency of

(A) 398 kHz (B) 398 Hz (C) 1592 kHz (D) 1592 Hz

54. A high pass RC filter acts as a pure differentiator when

(A) $\omega\tau = 1$ (B) $\omega\tau << 1$ (C) $\omega\tau >> 1$ (D) $\omega\tau = 0$

55. A differential amplifier having CMRR 50,000 has a differential mode gain of 500. The common mode gain is

(A) 0.0001 (B) 0.1 (C) 0.001 (D) 0.01

56. A combinational logic circuit which sends data coming from a single source to two or more separate destinations is

(A) Decoder (B) Encoder (C) Multiplexer (D) Demultiplexer

57. In signed-magnitude binary division, if the dividend is $(11100)_2$ and divisor is $(10011)_2$, then the result is _____

(A) $(00100)_2$ (B) $(10100)_2$ (C) $(11001)_2$ (D) $(01100)_2$

58. A logic function F(A,B,C) = (A+B'+C) (A'+B'+ C) (A+B'+C') can also be written as

(A) Σm(2,3,6,7) (B) Σm(1,2,5,6,7) (C) Σm(0,1,4,5,7) (D) Σm(0,2,4,6)

59. A 4 bit ripple counter and a 4 bit synchronous counter are made by flip-flops having a propagation delay of 10 ns each. If the worst case delay in the ripple counter and synchronous counter be R and S respectively, then

(A) R = 10 ns, S = 40 ns (B) R = 40 ns, S = 10 ns

(C) R = 10 ns, S = 30 ns (D) R = 30 ns, S = 10 ns

60. An 8 bit successive approximation ADC has full scale reading of 2.55 V and conversion time for analog input of 1 V is 20μs. Conversion time for a 2 V input is

(A) 20 μs (B) 10 μs (C) 40 μs (D) 50 μs

61. When a subroutine is called, the address of the instruction following the CALL instructions stored in/on the

(A) stack pointer (B) accumulator

(C) program counter (D) stack memory

62. The full scale output of a DAC is 10 mA. If resolution is to be less than 40 μA, then required bits of the DAC are

(A) 10 (B) 8 (C) 9 (D) 12

63. The following instructions are executed sequentially

```
Prog :  XRA   A
        MOV   L,A
        MOV   H,L
        INX   H
        DAD   H
```

After execution of this program the contents of HL pair is

(A) 0000H (B) 0101 H (C) 0002 H (D) 0001H

64. A sample and hold amplifier circuit is normally necessary before the following type of A/D converter :

(A) successive approximation converter

(B) flash type converter

(C) voltage to frequency converter

(D) dual slope integrating converter

65. Which of these interrupts of 8085 microprocessor will be recognized for both edge and level triggered inputs ?

(A) INTR (B) TRAP (C) RST 7.5 (D) RST 6.5

66. DMA is particularly suited for transfer of data between

(A) disk drive and CPU (B) disk drive and RAM

(C) disk drive and ROM (D) disk drive and I/O

67. Which of the following discrete-time systems is time invariant ?

(A) y[n] = n x[n] (B) y[n] = x[3n]

(C) y[n] = x[– n] (D) y [n] = x[n – 3]

68. The inverse Laplace transform of the function $\frac{s+5}{(s+1)(s+3)}$ is

(A) $2e^{-t} - e^{-3t}$ (B) $2e^{-t} - 2e^{-3t}$

(C) $e^{-t} - 2e^{-3t}$ (D) $e^{-t} - e^{-3t}$

69. The Fourier series for a periodic signal is given as x(t) = cos (1.2πt) + cos (2πt) + cos (2.8πt), the fundamental frequency of the signal is

(A) 1.4 Hz (B) 1.0 Hz (C) 0.2 Hz (D) 0.4 Hz

70. Identify the transfer function corresponding to an all pass filter from the following :

(A) $\frac{1 - s\tau}{1 + s\tau}$ (B) $\frac{1 + s\tau}{1 - s\tau}$ (C) $\frac{1}{1 + s\tau}$ (D) $\frac{s\tau}{1 + s\tau}$

71. The region of convergence of the Z-transform of the discrete-time signal $x[n] = 2^n u[n]$ will be

(A) $|z| > 2$ (B) $|z| < 2$ (C) $|z| > \frac{1}{2}$ (D) $|z| < \frac{1}{2}$

72. A digital filter has the transfer function $H(z) = z^2 + 1/ z^2 + 0.81$. If this filter has to reject 50 Hz interference from the input, then the sampling frequency of the input should be

(A) 200 Hz (B) 150 Hz (C) 100 Hz (D) 50 Hz

73. In an FM broadcast, the maximum frequency deviation allowed is 75 kHz, and the maximum modulation frequency is 15 kHz. The bandwidth is closest to

(A) 60 kHz (B) 180 kHz (C) 120 kHz (D) 240 kHz

74. A DSP convolves each discrete sample with four coefficients and they are equal to 0.25. This must be an

(A) high pass FIR filter (B) high pass IIR filter

(C) low pass FIR filter (D) low pass IIR filter

75. If the modulation index of an AM wave is changed from 0 to 0.5, the transmitted power increases by

(A) 12.5 % (B) 25 % (C) 50 % (D) 100 %

76. The Nyquist sampling rate for the signal

$s(t) = \frac{\sin(500\pi t)}{\pi t} \times \frac{\sin(700\pi t)}{\pi t}$ is given by

(A) 400 Hz (B) 600 Hz (C) 800 Hz (D) 1200 Hz

77. In a Pulse Coded Modulated(PCM) signal sampled at f_s and encoded into an n-bit code, the minimum bandwidth required for faithful reconstruction is

(A) $2nf_s$ (B) $nf_s/2$ (C) nf_s (D) f_s

78. In a digital communication system employing Frequency Shift Keying (FSK) the 0 and 1 bits are represented by sine waves of 10 kHz and 25 kHz respectively. These waveforms will be orthogonal for a bit interval of

(A) 45 μs (B) 50 μs (C) 200 μs (D) 250 μs

79. A PLL can be used to demodulate

(A) FM signal (B) PAM signal (C) PCM signal (D) DSB-SC signal

80. Source encoding in data communication system is done in order to

(A) enhance the information transmission rate

(B) reduce the transmission errors

(C) conserve the transmission power

(D) facilitate the clock recovery in the receiver

81. In Kelvin double bridge two sets of readings are taken when measuring a low resistance, one with the current in one direction and the other with direction of current reversed. This is done to

(A) eliminate the effect of contact resistance

(B) eliminate the effect of resistance of leads

(C) correct for changes in battery voltage

(D) eliminate the effect thermo-electric emfs

82. In a gravity controlled instrument, the deflection angle is proportional to

(A) the measurand (B) square of the measurand

(C) sine inverse of the measurand (D) sine of the measurand

83. In three-phase power measurement the power factor of load will be

(A) $\sqrt{3}\,\frac{(W_1 - W_2)}{(W_1 + W_2)}$ (B) $W_1 + W_2$

(C) $\frac{(W_1 - W_2)}{W_1 + W_2}$ (D) $\frac{(W_1 - W_2)}{\sqrt{W_1 + W_2}}$

84. A DC ammeter has a resistance of 0.1 Ω and its current range is 0-100 A. If the range of the ammeter is to extend to 0-500 A the meter requires which of the following shunt resistance ?

(A) 0.010 Ω (B) 0.025 Ω (C) 0.011 Ω (D) 1.0 Ω

85. A coil has been designed for high Q performance at a rated voltage and a specified frequency. If the frequency of operation is doubled and the coil is operated at the same voltage, then the Q factor and the active power P consumed by the coil will be affected as

(A) P is doubled and Q is halved

(B) P is halved and Q is doubled

(C) P remains constant and Q is doubled

(D) P decreased 4 times and Q is doubled

86. Wagner's Earth Devices are used in A.C. Bridge circuits for

(A) eliminating the effects of inter-component capacitances

(B) shielding the bridge elements

(C) eliminating the effect of earth capacitances

(D) eliminating the effect of stray electrostatic fields

87. Maxwell's inductance-capacitance bridge is used for measurement of inductance

(A) low Q coils (B) medium Q coils

(C) high Q coils (D) low and medium Q coils

88. The deflection of an electron beam on CRT screen is 10 mm. Suppose the pre-accelerating anode voltage is halved and the potential between deflecting plates is doubled, the deflection of the electron beam will be

(A) 80 mm (B) 40 mm (C) 20 mm (D) 10 mm

89. The resonant frequency of an RLC series circuit is 1.5 MHz with the tuning capacitors set at 150 pF. The bandwidth is 10 kHz. The effective resistance of the circuit is

(A) 4.7 Ω (B) 9.4 Ω (C) 14.75 Ω (D) 29.5 Ω

90. An average reading digital multimeter reads 10 V when fed with a triangular wave, symmetric about the time axis. For the same input an rms reading meter will read

(A) $20\sqrt{3}$ (B) $-10\sqrt{3}$ (C) $-20\sqrt{3}$ (D) $10\sqrt{3}$

91. The operation of megger is based on

(A) dynamo meter (B) electrostatic meter

(C) moving coil meter (D) moving iron meter

92. A 53 Hz reed type frequency meter is polarized with D.C. voltage. The new range of frequency meter is

(A) 106 Hz (B) 26.5 Hz (C) 53 Hz (D) 212 Hz

93. Light load adjustments for induction type energy meters are usually done at

(A) 10% of full load current (B) 5% of full load current

(C) 50 % of full load current (D) 1% of full load current

94. An astable mutivibrator uses a resistance of 100 Ω and capacitance of 0.01 μF.The frequency of the square wave generated by it is

(A) 924 Hz (B) 593 Hz (C) 693 Hz (D) 110 Hz

95. A transfer function has two zeros at infinity. Then the relation between the numerator degree (N) and denominator degree (M) of the transfer function is

(A) N = M + 2 (B) N = M – 2 (C) N = M +1 (D) N = M – 1

96. The system with open-loop transfer function

$G(s)\,H(s) = \frac{1}{s(s^2+s+1)}$ has a gain margin of

(A) – 6 dB (B) Zero (C) 3.5 dB (D) 6 dB

97. An amplifier with resistive negative feedback has two left half plane poles in its open-loop transfer function. The amplifier

(A) will be stable for all frequencies

(B) will always be unstable at high frequencies

(C) may be unstable, depending on the feedback factor

(D) will oscillate at low frequencies

98. The proportional gain (K) of a PID controller can be expressed in terms of its Proportional Band (PB) as

(A) PB (B) 100 × PB (C) PB / 100 (D) 100 / PB

99. The maximum phase shift that can be provided by a lead compensator with transfer function $G(s) = \frac{1+6s}{1+2s}$ is

(A) 15° (B) 30° (C) 45° (D) 60°

100. In the Bode plot of a unity feedback control system, the value of phase of *G(jw)* at the gain crossover frequency is – 120°. The phase margin of the system is

(A) – 120° (B) – 60° (C) 60° (D) 120°

101. A temperature control system is usually very sluggish. To improve its dynamics

(A) a PI controller can be used

(B) an integral controller can be used

(C) a PID controller with large I and negligible D action can be used

(D) a PD controller can be used

102. A process in a feedback loop with a proportional controller with ultimate gain of $K_u = 10$ is oscillating at a frequency of $P_u = 8$ Hz. The Zeigler-Nichols setting for the proportional controller is

(A) 5 (B) 10 (C) 8 (D) 1.25

103. Consider the following standard state-space description of a linear time-invariant single input single output system : $x' = Ax + Bu$, $y = Cx + Du$.

Which one of the following statements about the transfer function cannot be true if $D \neq 0$?

(A) The system is unstable.
(B) The system is strictly proper.
(C) The system is low pass.
(D) The system is of type zero.

104. Which of the following is commonly used to convert the angular position of shaft into an electric signal ?

(A) Servo motor (B) Synchros (C) Stepper motor (D) LVDT

105. Identify the sequence of operation in fuzzy control :

(I) Rule base
(II) Fuzzification
(III) Fuzzy inference
(IV) Defuzzification

(A) I-II-III-IV (B) II-I-IV-III (C) II-I-III-IV (D) I-III-II-IV

106. Which of the following controller produces Zero offset ?

(A) On-Off control
(B) Proportional
(C) Derivative
(D) Integral

107. A step index optical fiber, whose refractive indices of the core and cladding are 1.44 and 1.40 respectively, is surrounded by air. Its numerical aperture is

(A) 0.12 (B) 0.75 (C) 0.06 (D) 0.34

108. Infrared spectrometry is used for the determination of the molecular structure of the molecules having

(A) Ionic bonds
(B) Covalent bonds
(C) Metallic bonds
(D) Hydrogen bonds

109. Find the distance between two successive positions of the movable mirror of Michelson interferometer giving best fringes in the case of sodium source with lines of $\lambda = 5890$ Å and 5896 Å .

(A) 289 nm (B) 282 nm (C) 280 nm (D) 308 nm

110. What is the shortest wavelength of X-rays produced in an X-ray tube with accelerating potential as 70 kV ?

(A) 0.015 (B) 0.018 (C) 0.017 (D) 0.019

111. In a spectrophotometer, the monochromator must be able to resolve two wavelengths 599.9 nm and 600.1 nm. The required resolution is

(A) 100 (B) 500 (C) 1000 (D) 3000

112. A photo diode made of Ga-As has a band gap of 1.43 eV. Find the wavelength at which it will start to operate

(A) 0.68 μm (B) 0.87 μm (C) 0.73 μm (D) 0.84 μm

113. The time interval between two successive R peaks in ECG is 0.8 s. Then, the heart rate is

(A) 12.5 bpm (B) 72 bpm (C) 60 bpm (D) 75 bpm

114. In laser, the process of creating a population inversion by supplying energy to the medium is called

(A) pumping (B) optical resonator

(C) Q-switching (D) trimming

115. If half life of the radioactive radon is 3.8 days, then time at the end of which $\frac{1}{20}^{\text{th}}$ of the radon sample will remain undecayed is

(A) 3.8 days (B) 16.5 days (C) 33 days (D) 76 days

116. A He-Ne laser emit light of wavelength 672.8 nm has an output power of 2.3 mW/s. How many photons are emitted each minute by the laser ?

(A) 4.6×10^{17} photons/min (B) 4.2×10^{16} photons/min

(C) 9.8×10^{16} photons/min (D) 5.6×10^{17} photons/min

117. The cardiac output is measured with the help of indicator dilution method. The quantity of indicator injected is 20 mg and the area under the die dilution curve is found to be 180 mg s/L. Find the cardiac output.

(A) 8.66 L/min (B) 8 L/min (C) 6.66 L/min (D) 6 L/min

118. Which of the following type of image is produced by a CT scan machine ?

(A) 1-D image (B) 2-D image (C) 3-D image (D) All the above

119. Korotkoff sounds are used

(A) as a reference for sound level measurement

(B) for studying heart muscle functioning

(C) for study of heart valve functioning

(D) for blood pressure measurement

120. In an electromagnetic blood flow meter, the induced voltage is directly proportional to the

(A) square root of the blood flow rate

(B) blood flow rate

(C) square of the blood flow rate

(D) logarithm of the blood flow rate

SPACE FOR ROUGH WORK