ELECTRICAL SCIENCE

IMPORTANT INSTRUCTIONS AND BRANCHWISE INDEX FOR THE CANDIDATES

Question Nos. 1 to 45 is compulsory and common to all the branches. Question Nos. 46 to 75 are optional. Sub-branches are there in this booklet. The candidate has to opt any one branch according to his/her Application Form.

PART – A

(Common to E&E / E&C / TC / BME / ME / IT)

SECTION – I

Each question carries one mark. **(30 × 1 = 30)**

1. The matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ -2 & -4 & -6 \end{bmatrix}$ is

   (A) Singular (B) Non-singular

   (C) Symmetric (D) Scalar matrix

2. The differential equation $\frac{dy}{dx} = y^2$ is

   (A) Linear (B) Non-linear

   (C) Quasi-linear (D) None of these

3. If A and B are mutually exclusive events, then $P(A \cup B) =$

   (A) $P(A) + P(B) - P(A \cap B)$ (B) $P(A) + P(B)$

   (C) $P(A) - P(B)$ (D) $P(A) \times P(B)$

4. If r is the correlation coefficient, then which of the following is correct ?

   (A) $r > 1$ (B) $r > 0$

   (C) $0 \leq r \leq 1$ (D) $-1 \leq r \leq 1$

5. The Gray Code equivalent of Binary 1100 is

   (A) 1011 (B) 1101

   (C) 1010 (D) 1100

Space For Rough Work

6. Meaning of decoding is

(A) Binary addition (B) Data transmission

(C) Demultiplexing (D) Storage of binary information

7. Flip flop cannot be called as

(A) Bistable multivibrator (B) One bit memory unit

(C) Latch (D) Combinational circuit

8. In which of the code only one bit changes at each time ?

(A) BCD (B) Binary code

(C) Excess-3 code (D) Gray code

9. $(0.3125)_{10}$ when converted to base 8 gives

(A) $(0.16)_8$ (B) $(0.26)_8$

(C) $(0.24)_8$ (D) $(0.124)_8$

10. Modulo-2 addition is represented by

(A) $F = \bar{X}Y + X\bar{Y}$ (B) $F = XY + X\bar{Y}$

(C) $F = XY + \bar{X}\bar{Y}$ (D) $F = XY + X$

11. Intel 8085 microprocessor has two registers known as primary data pointers. These are

(A) Register B & C (B) Register D & E

(C) Register H & L (D) Register SP

12. A Boolean variable or its complement is known as

(A) literal (B) prime implicant

(C) essential prime implicant (D) non-essential prime implicant

Space For Rough Work

13. Gauss law relates the electric field intensity E with volume charge density ρ at a point as

(A) $\nabla \times E = \varepsilon_0 \rho$ (B) $\nabla . E = \rho/\varepsilon_0$

(C) $\nabla \times E = \rho/\varepsilon_0$ (D) $\nabla . E = \varepsilon_0 \rho$

14. Which of the following method of biasing provides the best operating point stability ?

(A) Two battery bias (B) Collector to base bias

(C) Fixed bias (D) Self bias

15. In a JFET, at pinch-off voltage applied on the gate

(A) The drain current becomes almost zero

(B) The drain current begins to decrease

(C) The drain current is almost at saturation value

(D) The drain-to-source voltage is close to zero volts

16. Transistor is a

(A) Current controlled current device.

(B) Current controlled voltage device.

(C) Voltage controlled current device.

(D) Voltage controlled voltage device.

17. An oscillator of the LC type that has a split capacitor in the circuit is

(A) Hartley oscillator (B) Colpitts oscillator

(C) Weinbridge oscillator (D) R-C phase shift oscillator

18. The 'slew rate' of an operational amplifier indicates

(A) how fast its output current can change

(B) how fast its output impedance can change

(C) how fast its output power can change

(D) how fast its output voltage can change when a step input signal is given

Space For Rough Work

19. Active loaded MOS differential circuit has a

(A) high CMRR (B) low CMRR

(C) high delay (D) high differential gain

20. The maximum binary number counted by a ripple counter that uses four FlipFlops is

(A) $(0000)_2$ (B) $(1011)_2$

(C) $(1111)_2$ (D) $(0101)_2$

21. The electric field strength at any point equals

(A) The potential gradient at that point

(B) Negative of the potential gradient at that point

(C) The charge at that point

(D) Negative of the charge at that point

22. The Laplace transform of a unit ramp function starting at t = a, is

(A) $1/(s + a)^2$ (B) $e^{-as}/(s + a)^2$

(C) e^{-as}/s^2 (D) a/s^2

23. In an RC coupled CE amplifier, typical value of coupling capacitor is

(A) 1000 pF (B) 0.1 μF

(C) 10 μF (D) 0.01 μF

24. The device which behaves like a SCR is

(A) UJT (B) Triac

(C) MOSFET (D) SRD

Space For Rough Work

25. Strapping is used in a Magnetron to

(A) prevent mode jumping
(B) reduce frequency drift
(C) ensure proper bunching
(D) dissipate heat

26. HDLC is a term for

(A) Data Communication protocol
(B) Synchronizing pulse
(C) Gain control in receivers
(D) Error checking

27. Which family of the following ICs has the highest speed ?

(A) DTL
(B) ECL
(C) TTL
(D) CMOS

28. Which of the following microwave tubes can be considered as broadband devices ?

(A) Magnetrons
(B) Klystron
(C) Reflex Klystron
(D) Travelling Wave Tube (TWT)

29. Baud is

(A) Total number of bits per second in each character
(B) Reciprocal of shortest signal element in a character
(C) Duration of a character in data transmission
(D) None

30. Energy stored in a capacitor is a function of voltage is given by

(A) CV^2
(B) $V^2/2C$
(C) $CV^2/2$
(D) $V/2C$

Space For Rough Work

SECTION – II

Each question carries two marks. **(15 × 2 = 30)**

31. $L\left[\frac{\sin t}{t}\right] =$

(A) $\frac{1}{s^2+1}$ (B) $\cot^{-1} s$

(C) $\cot^{-1}(s-1)$ (D) $\tan^{-1} s$

32. The eigen values of a matrix $A = \begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$ are

(A) –2, 3, 6 (B) 0, 3, 6

(C) 2, –3, –6 (D) 0, 0, –6

33. The unit tangent vector to the curve $x = t$, $y = t^2$, $z = t^3$ at the point $(-1, 1, -1)$ is

(A) $\frac{1}{\sqrt{14}}(\hat{i} + 2\hat{j} + 3\hat{k})$ (B) $\frac{1}{\sqrt{14}}(\hat{i} - 2\hat{j} + 3\hat{k})$

(C) $\frac{1}{\sqrt{3}}(\hat{i} + \hat{j} + \hat{k})$ (D) $\frac{1}{\sqrt{3}}(\hat{i} - \hat{j} + \hat{k})$

34. For a poisson variata x ; $P(x = 1) = P(x = 2)$, the mean of x is

(A) 3 (B) 4

(C) 2 (D) 1

Space For Rough Work

35. The following sequence of instructions are executed by 8085 microprocessor:

1000 LXI SP, 27FF

1003 CALL 1006

1006 POP H

The contents of the stack pointer (SP) and the HL register pair on completion of execution of these instructions are

(A) SP = 27FF, HL = 1003 (B) SP = 27FD, HL = 1003

(C) SP = 27FF, HL = 1006 (D) SP = 27FD, HL = 1006

36. For the system described by the state equation

$\dot{X} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0.5 & 1 & 2 \end{bmatrix} X + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} U$, if the control signal U is given by U = [– 0.5 – 3 – 5] X + V, then the Eigen values of the closed loop system will be

(A) 0, – 1, – 2 (B) 0, – 1, – 3

(C) – 1, – 1, – 2 (D) 0, – 1, – 1

37. The minimized form of logical expression

$\bar{A}\bar{B}\bar{C} + \bar{A}B\bar{C} + \bar{A}BC + AB\bar{C}$ is

(A) $\bar{A}\bar{C} + B\bar{C} + \bar{A}B$ (B) $A\bar{C} + \bar{B}C + \bar{A}B$

(C) $\bar{A}C + \bar{B}C + \bar{A}B$ (D) $A\bar{C} + \bar{B}C + A\bar{B}$

Space For Rough Work

38. A class A transformer coupled transistor power amplifier is required to deliver a power output 10 Watts. The maximum power rating of the transistor should not be less than

(A) 5 W (B) 10 W

(C) 20 W (D) 40 W

39. A second order system has a transfer function given by

$$G(S) = \frac{25}{S^2 + 8S + 25}$$

If the system, initially at rest is subjected to a unit step input at t = 0, the second peak in the response will occur at

(A) π sec (B) $\pi/3$ sec

(C) $2\pi/3$ sec (D) $\pi/2$ sec

40. The decimal equivalent of hex number 1A53 is

(A) 6793 (B) 6739

(C) 6973 (D) 6379

41. The simplification of the Boolean expression $ABC + \overline{ABC}$ is

(A) 0 (B) 1

(C) A (D) BC

42. If the input to T-flip flop is 100 Hz signal, the final output of the three T-flip flops in cascade is

(A) 1000 Hz (B) 500 Hz

(C) 333 Hz (D) 12.5 Hz

Space For Rough Work

43. For the circuit shown in Fig.1, the input resistance Rid will be

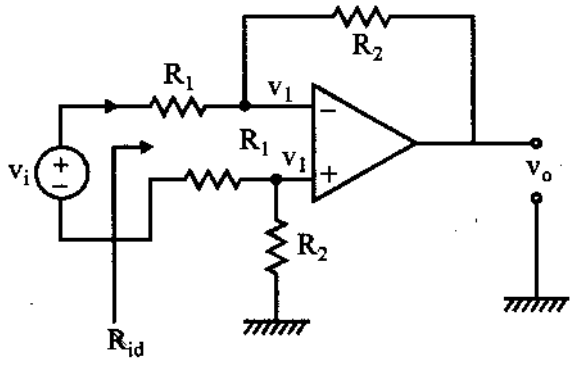

Fig. 1

(A) $2R_1$ (B) $2R_1 + R_2$

(C) $2(R_1 + R_2)$ (D) Infinity

44. The Laplace transform of e^{-2t} is

(A) $\frac{1}{2 \cdot s}$ (B) $\frac{2}{s}$

(C) $\frac{2}{s+1}$ (D) $\frac{1}{s+2}$

45. In integrated circuits, npn construction is preferred to pnp construction because

(A) npn construction is cheaper

(B) to reduce diffusion constant, n-type collector is preferred

(C) npn construction permits higher packing of elements

(D) p-type base is preferred

Space For Rough Work

Note : Please choose to answer Part-B below corresponding to your basic degree

PART - B

(E & E : ELECTRICAL AND ELECTRONICS ENGINEERING)

SECTION – I

Each question carries one mark. **(20 × 1 = 20)**

46. The armature of a DC generator is laminated to

(A) reduce the bulk
(B) provide passage for cooling air
(C) insulate the core
(D) reduce the eddy current loss

47. In DC shunt generator the voltage build up is generally restricted by

(A) Speed limitation
(B) Armature heating
(C) Insulate the core
(D) Saturation of the core

48. No Load speed of which of the following DC motor will be highest ?

(A) Shunt Motor
(B) Series Motor
(C) Cumulative Component Motor
(D) Differently Compound Motor

49. What will happen if the back emf of a DC motor vanishes suddenly ?

(A) The motor will stop
(B) The motor will continue to run
(C) The armature may burn
(D) The motor will run noisly

50. Which of the following does not change in a transformer ?

(A) Current
(B) Voltage
(C) Frequency
(D) All of the above

Space For Rough Work

51. Which of the following is the main advantage of an auto transformer over a two winding transformer ?

(A) Hysteresis losses are reduced (B) Saving in winding material

(C) Copper losses are negligible (D) Eddy current losses are totally eliminated

52. In an induction motor, on no load, the slip is generally

(A) less than 1% (B) 1.5%

(C) 2% (D) 4%

53. In a 3 ph Induction Motor, the number of poles in the rotor winding is always

(A) zero

(B) more than the number of poles in the Stator

(C) less than number of poles in Stator

(D) equal to number of poles in Stator

54. ZPF method for an alternator is generally used to determine

(A) Synchronous Impedance (B) Efficiency

(C) Voltage regulation (D) None

55. If the input to the prime mover of an alternator is constant but the excitation is changed, then the

(A) Pf of the load remains constant

(B) reactive component of the output is changed

(C) active component of the output is changed

(D) all of the above

56. Under which of the following conditions, hunting of synchronous motor is likely to occur ?

(A) Periodic variations of Load (B) Over excitation

(C) Over loading for long periods (D) Small and constant load

57. A synchronous motor can be used as asynchronous condenser when it is

(A) under loaded (B) over loaded

(C) under excited (D) over excited

Space For Rough Work

58. The capacity factor of a plant is equal to
(A) max load/plant capacity (B) avg load/max load
(C) avg load/plant capacity (D) max load/avg load

59. The inductance of the line is minimum when
(A) GMD is high (B) GMR is high
(C) both GMD & GMR are high (D) GMD is low & GMR is high

60. A large diversity factor of the load in a power system
(A) reduces the installation cost (B) increases the installation cost
(C) does not affect the installation (D) none

61. In suspension type insulator, the potential drop is
(A) max across the lowest disc
(B) max across the top most disc
(C) uniformly distributed over the disc
(D) non-uniformly distributed over the disc

62. Which distribution system is more reliable ?
(A) Ring main system (B) Tree system
(C) Radial system (D) All are equally reliable

63. The inertia constants of two groups of machines which do not swing together are M_1 and M_2
(A) $M_1 + M_2$ (B) $M_1 - M_2\, z_f M_1\, M_2$
(C) $\frac{M_1 M_2}{M_1 + M_2}$ (D) $\sqrt{M_1 M_2}$

64. Zero sequence currents can flow from a line into a transformer bank if the windings are
(A) Grounded star/delta (B) Delta / star
(C) Star / grounded star (D) Delta / delta

65. Load flow study is carried out for
(A) Fault calculations (B) Stability studies
(C) System planning (D) Load frequency control

Space For Rough Work

SECTION – II

Each question carries two marks. **10 × 2 = 20**

66. A 66 KV system has string insulator having five discs and the earth to disc capacitance ratio is 0.10.The string efficiency will be

(A) 89% (B) 75%

(C) 67% (D) 55%

67. A 100 KVA t_r has 4% impedance and 50 KVA t_r has 3% impedance, when they are operated unparallel, which transformer will reach full load first ?

(A) Low over load currents (B) Short circuit current

(C) Under all abnormal currents (D) The combination is never

68. If a combination of HRC fuse and circuits breaker are used, the circuits breaker operates for

(A) Low over load currents (B) Short circuits currents

(C) Under all abnormal currents (D) The combination is never

69. If the penalty factor of a plant is unity, its increments transmission loss is

(A) 11.0 (B) – 1.0

(C) Zero (D) None

70. A power system is subjected to a fault which makes the zero seq component of current equal to zero. The nature of the fault is

(A) Double line to ground fault (B) Double line fault

(C) Line to ground fault (D) 3 ph to ground fault

Space For Rough Work

71. In case the back EMF and the speed of a DC Motor are doubled, the torque developed by the motor will

(A) remain unchanged
(B) reduce to one fourth volume
(C) increase four times
(D) double

72. For a DC shunt Motor, if the excitation is changed

(A) Torque remain constant
(B) Torque will change but power remain constant
(C) Torque and Power both change
(D) Torque, Power and Speed all will change

73. The elements of the Jacobin matrix in Newton Raphson method for load flow Studies contain

(A) Derivative
(B) Real Numbers
(C) Partial
(D) Partial derivatives

74. Slip test is used for calculating the voltage regulation of

(A) Non salient Pole Alternator
(B) Salient Pole Alternator
(C) Turbo Alternator
(D) None

75. Equal area criteria is used for the analysis of

(A) Dynamic Stability
(B) Steady State Stability
(C) Transient Stability
(D) None

Space For Rough Work

PART – B

(E&C AND TC: Electronics and Communication Engineering and Telecommunication Engineering)

SECTION – I

Each question carries one mark. **(20 × 1 = 20)**

46. The ASCII is an input output code

(A) It is a two bit code
(B) It is a four bit code
(C) It is a seven bit code
(D) It is an eight bit code

47. A digital circuit designed to execute exactly one program is known as

(A) General purpose processor
(B) Application specific instruction set processor
(C) Single purpose processor
(D) All purpose processor

48. A half wave folded dipole has a radiation resistance of

(A) 72 Ω
(B) 50 Ω
(C) 144 Ω
(D) 288 Ω

49. If several stations in a network want to use a single channel without interfering with one another, the technique used is called

(A) Carrier sense
(B) Phantom-freeze
(C) Packet switching
(D) Multiplexing

50. Modulation index of the frequency modulation depends on

(A) Amplitude and frequency of the modulating signal
(B) Frequency and amplitude of carrier signal
(C) Carrier frequency
(D) Sampling frequency

Space For Rough Work

51. To limit the rate of rise of SCR anode current a small
(A) Inductor is inserted in cathode circuit
(B) Inductor is inserted in anode circuit
(C) Capacitor is inserted in anode circuit
(D) Capacitor is inserted in cathode circuit

52. The important application of Schmitt trigger is
(A) To convert slowly varying input voltage to abrupt voltage change
(B) To convert abruptly varying input voltage into slowly varying output
(C) To change the frequency of the input
(D) None

53. The 3dB band width means the frequency at which
(A) The open loop voltage gain reduced to 0.707
(B) The open loop gain reduced to unity
(C) Maximum voltage of a signal is without distortion
(D) It is medium wave band width of radio receiver

54. The noise figure of a receiver is a measure of
(A) Excess noise generated
(B) Bandwidth of the receiver
(C) Gain of the receiver
(D) Operating frequency

55. The frequency deviation in FM system is proportional to
(A) Modulating frequency
(B) Carrier amplitude
(C) Modulating signal amplitude
(D) None

56. The velocity of electromagnetic wave in a coaxial cable is
(A) Equal to the velocity in free space
(B) Less than the velocity in free space
(C) Greater than the velocity in free space
(D) None

57. The Smith Chart generally covers a distance of
(A) Quarter wavelength
(B) Half wavelength
(C) One wavelength
(D) Twice the wavelength

Space For Rough Work

58. In which of the counter the clock input is common to all flip flops ?
(A) Up counter (B) Down counter
(C) Asynchronous counter (D) Synchronous counter

59. An OPAMP integrator will be
(A) Capacitor at input (B) Diode at input
(C) Diode feedback (D) Capacitor feedback

60. The term free running is usually associated with
(A) Monostable multivibrator (B) Astable multivibrator
(C) Bistable multivibrator (D) Schmitt trigger

61. The feedback network of a phase shift oscillator is usually consist of
(A) RC circuit (B) RL circuit
(C) LC circuit (D) RLC circuit

62. The bilinear transformation is characterized by
(A) $s = \frac{2(1 + Z^{-1})}{T(1 - Z^{-1})}$ (B) $s = \frac{2(1 - Z^{-1})}{T(1 + Z^{-1})}$
(C) $s = \frac{T(1 - Z^{-1})}{2(1 + Z^{-1})}$ (D) None of the above

63. The number of complex multiplications required for calculating the DIT FFT is
(A) $N\log_2 N$ (B) $\frac{N}{2}\log_2 N$
(C) $\log_2 N$ (D) $N\log_2(N - 1)$

64. The Boolean expression a + bc is equal to
(A) a + b (B) b + c
(C) (a + b) (a + c) (D) ab + c

65. How many bits are needed to address 64k Bytes of memory locations ?
(A) 3 (B) 10
(C) 16 (D) 32

Space For Rough Work

SECTION – II

Each question carries two marks. **10 × 2 = 20**

66. For a logical expression $\overline{\bar{A}\bar{B} + \bar{A} + AB}$ is

(A) 0 (B) A

(C) $\bar{A}$ (D) 1

67. Nyquist sampling interval for the signal sinc($100\pi t$) is

(A) 2 ms (B) 3.18 ms

(C) 8.29 ms (D) 7.29 ms

68. Given $W_{64}^{16} = W_{128}^{x}$, solve for x.

(A) 8 (B) 16

(C) 32 (D) 128

69. The linear convolution of the sequences $x_1(n) = [2, 1, 1, 2]$ and $x_2(n) = [1, -1, -1, 1]$ is

(A) [2, –1, –2, 2, –2, –1, 2] (B) [–2, –1, –2, 2, –2, –1, –2]

(C) [2, 1, –2, 2, –2, 1, 2] (D) [2, 1, 2, –2, 2, –1, 2]

70. If x (n + qN) = x(n), where 'q' is an integer, what is the fundamental period of the signal x(n) ?

(A) qN (B) q

(C) N (D) n + qN

Space For Rough Work

71. When an analog signal of bandwidth 20 kHz is sampled at a rate of 40 kHz, and quantized into 16 levels.The resultant digital signal is transmitted using M-ary PSK with raised cosine pulse (roll-off factor 0.3).A channel with a 110 kHz bandwidth is available to transmit the data.The baud rate is

(A) 20 kilo symbol/sec (B) 80 kilo symbol/sec

(C) 30 kilo symbol/sec (D) 45 kilo symbol/sec

72. For a communication system, using coherent BPSK, it is necessary to keep the degradation due to phase error about 0.1 dB or less.The phase error in degrees, the system can tolerate is

(A) 9 (B) 5

(C) 6 (D) 7.1

73. The efficiency η of AM with 50 percent modulation is

(A) 33.3% (B) 11.1%

(C) 22.2% (D) 44.4%

74. The DFT of the sequence $x(n)=[2, 1, 2, 1]$ is

(A) [1, 1, 2, 2] (B) [6, 2, 0, 0]

(C) [6, 0, 2, 0] (D) [4, 2, 4, 2]

75. The Nyquist rate for the analog signal $x(t) = 3\cos 100\pi t - 6\sin 400\pi t + 4\cos 60\pi t$ is

(A) 100 (B) 200

(C) 300 (D) 400

Space For Rough Work

PART – B

(BME & ME: BIOMEDICAL ENGINEERING & MEDICAL ELECTRONICS)

SECTION – I

Each question carries one mark. **(20 × 1 = 20)**

46. Volume of air that can be taken in and expelled out by maximum inspiration is

(A) lung capacity
(B) vital capacity
(C) tidal volume
(D) respiratory volume

47. Which of the following flow measurement techniques is not based on the principle of indicator dilution ?

(A) Plethysmography
(B) Injecting saline
(C) Injecting indocyanine green
(D) Fick technique

48. Precordial leads is also known as

(A) avL, aVF, aVF
(B) V1 – V6
(C) chest leads
(D) both (B) and (C)

49. An electrode converts

(A) Voltage in body to voltage in an amplifier
(B) Action potentials to digital signals
(C) Ionic current to electron current
(D) Reduction to oxidation reactions

50. A mutation in the reproductive cell due to excessive x-ray exposure is an example of

(A) radiative effect
(B) meiotic effect
(C) somatic effect
(D) genetic effect

51. The cathode of the tube is composed of

(A) suction cup
(B) metallic cup
(C) electronic cup
(D) none of these

Space For Rough Work

52. In pulse echo systems, the number of transducer(s) is

(A) zero (B) one

(C) two (D) three

53. A weaker MR signal is obtained for tissue with _____ T1

(A) long (B) short

(C) neither of them (D) strong

54. Double integration of a unit step function would lead to

(A) An impulse (B) A parabola

(C) A ramp (D) A doublet

55. The Laplace Transform of f (t) = t is given by

(A) $1/S^2$ (B) $1/S$

(C) $2/S^3$ (D) S

56. The Z-transform of the time function $\sum_{k=0}^{\infty} \delta(n-k)$ is

(A) $z - 1/z$ (B) $Z/(Z-1)^2$

(C) $Z/(Z-1)$ (D) $(Z-1)^2/Z$

57. The discrete time system described by $y(n) = x(n)^2$ is

(A) Causal, linear and time varying

(B) Causal, non-linear and time varying

(C) Non-Causal, linear and time invariant

(D) Non-Causal, non-linear and time variant

Space For Rough Work

58. Averaging 100 responses will improve the signal to noise ratio by what factor ?

(A) 100 (B) 10

(C) 1 (D) none of these

59. FIR filter has

(A) finite impulse response (B) linear phase

(C) stability (D) all of these

60. Huffman algorithm is one of the _____ algorithm.

(A) lossless (B) lossy

(C) neither lossless nor lossy (D) none of these

61. Differentiation technique is used as one of the QRS detection technique based on

(A) first derivative (B) second derivative

(C) first and second derivatives (D) none of these

62. In 7-bit Hamming (7, 4) code, the h_2 bit associated with 4 bit binary number is

(A) $b_3 \oplus b_2 \oplus b_0$ (B) $b_3 \oplus b_1 \oplus b_0$

(C) $b_2 \oplus b_1 \oplus b_0$ (D) $b_3 \oplus b_2 \oplus b_1$

63. The high boost filter expression in an image enhancement is represented as

(A) HPF image – LPF image (B) LPF image – original image

(C) A*original image – LPF image (D) A*original image – HPF image

64. Which of the following image transform is input dependent ?

(A) Walsh (B) Hadamard

(C) Haar (D) Karhunen-Loeve

65. _____ redundancy is associated with the representation of data.

(A) Interpixel (B) Coding

(C) Psychovisual (D) Temporal

Space For Rough Work

SECTION – II

Each question carries two marks. **(10 × 2 = 20)**

66. When ECG is recorded by connecting two electrodes, one is on right arm and other is on left leg, recording is made in

(A) Lead I configuration

(B) Lead II configuration

(C) Lead I and Lead II configurations

(D) Lead III configuration

67. Which of the following are the stages of respiration in the correct order ?

(A) Gaseous transport, breathing, tissue respiration and cellular respiration

(B) Breathing, gaseous transport, tissue respiration and cellular respiration

(C) Breathing, gaseous transport, cellular respiration and tissue respiration

(D) Breathing, tissue respiration, cellular respiration and gaseous transport

68. X-ray electromagnetic radiation lie in the range

(A) 2.5 μm to 25 μm (B) 400 nm to 700 nm

(C) 0.1 mm to 1 mm (D) 10 nm to 100 nm

69. Volume of blood the heart pumps to systemic circulation each day is

(A) 4.3×10^3 cm^3 (B) 4.3×10^5 cm^3

(C) 8.3×10^3 cm^3 (D) 8.3×10^6 cm^3

70. The most important electrolyte present in intracellular fluid is :

(A) Sodium

(B) Calcium

(C) Chloride

(D) Potassium

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71. N-point FFT requires _____ number of stages

(A) N^2 (B) $N\log_2 N$

(C) $\log_2 N$ (D) N

72. The convolution between the two sequences $x[n] = \{1,4,2\}$ and $h[n] = \{1,1,1,1\}$ is

(A) {1,3,7,7,6,1} (B) {1,5,7,7,6,2}

(C) {1,3,7,6} (D) {1,1,1,1}

73. The filter has $H(z) = (z - 1)/(z^2 - z + 1/2)$, it will be

(A) stable (B) unstable

(C) marginally stable (D) none of these

74. The power law transformation is represented as

(A) $s = L - 1 - r$ (B) $s = c\log(1 + r)$

(C) $s = cr^{\gamma}$ (D) none of these

75. The smallest discernible change in gray level is called _____ and the effect caused by the insufficient number of gray levels is called _____

(A) false contouring, gray level resolution

(B) spatial resolution, thresholding

(C) gray level resolution, false contouring

(D) false contouring, gray level resolution

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PART – B

(IT: INSTRUMENTATION TECHNOLOGY)

SECTION – I

Each question carries one mark. **(20 × 1 = 20)**

46. The error observed when the instrument is under the reference condition is called

(A) Absolute error (B) Intrinsic error

(C) Relative error (D) Random error

47. Hysteresis is usually expressed as a percentage of the full scale output measured at _____ full scale level

(A) 15% (B) 25%

(C) 50% (D) 75%

48. Desirable dynamic characteristics of a measurement system are

(A) fast response and fidelity (B) fast response and dynamic error

(C) fidelity and measuring lag (D) none of these

49. The values of static stiffness and compliance in a measurement system determine the amount of

(A) current drain from a system (B) potential drain from a system

(C) power drain from a system (D) energy drain from a system

50. Unbonded strain gauges are

(A) exclusively used for transducer applications

(B) exclusively used for stress analysis

(C) used for unbonded strains only

(D) none of these

51. Dynamometer type moving coil instruments are provided with

(A) eddy current damping (B) pneumatic damping

(C) fluid friction damping (D) electrostatic damping

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52. A force digital transducer measures the pressure in the range of 0-200 N with a resolution of 0.1% of full scale. The smallest change it can measure is

(A) 0.2 N (B) 0.4 N

(C) 0.5 N (D) 1.0 N

53. Given F(z) the inverse transform $z^{-1}(F(z))$ yields

(A) f(t) (B) f(t + kT)

(C) f(kT) for k = 0,1,2,3... (D) f(t – kT)

54. Which of the following gives the describing function of an ideal relay ?

(A) $4M/\pi X$ (B) $3X^2/4$

(C) $4M/\pi X$ with angle $\tan^{-1}(1/X)$ (D) none of these

55. Which of the following is not a performance measure ?

(A) $\int_{t_0}^{t_f} [x^T Qx + u^T Ru]dt$ (B) $\int_{t_0}^{t_f} dt$

(C) $\int_{t_0}^{t_f} |u|\, dt$ (D) $Ax + Bu$

56. Matrix Riccatti equation is used to solve which type optimal control system ?

(A) Minimum energy problem (B) Quadratic regulator problem

(C) Minimum time problem (D) Minimum fuel problem

57. Light appears to travel in straight lines, since

(A) it is not absorbed by the atmosphere

(B) it is not reflected by the atmosphere

(C) its wavelength is very small

(D) its velocity is very large

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58. Programmable controllers originally intended for _____ logic systems.
(A) 0% (B) 25%
(C) 50% (D) 100%

59. For observing a cricket match, binocular is preferred to terrestrial telescope because the binocular
(A) is very easy to handle
(B) provides three dimensional vision
(C) produces image free of chromatic aberration
(D) produces erect image

60. Volume of blood the heart pumps to systemic circulation each day is
(A) 4.3×10^3 cm^3 (B) 4.3×10^5 cm^3
(C) 8.3×10^3 cm^3 (D) 8.3×10^6 cm^3

61. The electrodes generated in x-rays can be controlled
(A) in groups (B) in pairs
(C) independently (D) none of these

62. When $x[n]=\{1, 2, 3, 4, 5\}$, $h[n] = \{1\}$ then $x[n]*h[n]$ is
(A) {1, 3, 6, 10, 15} (B) {1, 2, 3, 4, 5}
(C) {1, 4, 9, 16, 20} (D) {1, 4, 6, 8, 10}

63. Periodic function of half wave symmetry is necessarily
(A) an even function (B) an odd function
(C) neither odd nor even (D) both odd and even

64. Fourier transform of f(t) is $\int_0^\infty \phi(t)\cos \omega t \, dt$ if and only if
(A) t is real and f(t) is real (B) t is real and f(t) is even
(C) f(t) is real and f(t) is odd (D) the function is f(t) $e^{-j\omega t}$

65. The discrete time equation $y(n + 1) + 0.5ny(n) = 0.5x(x + 1)$ is not attributable to a
(A) memoryless system (B) time varying system
(C) linear system (D) causal system

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SECTION – II

Each question carries two marks. **(10 × 2 = 20)**

66. A piezoelectric transducer has capacitance of 1000pF a charge sensitivity of 40×10^{-3}c/m. Capacitance of connecting cable is 300pF and oscillator for readout is 50pF in parallel with resistance of 1MΩ.Find out the sensitivity of transducer alone.

(A) 10×10^6V/m (B) 20×10^6V/m

(C) 30×10^6V/m (D) 40×10^6V/m

67. A hydraulic testing machine is to apply a maximum force of 300 kN/m^2. The diameter of ram is 130 mm and arc of 270° the pressure is

(A) 22.6 GN/m^2 (B) 22.6 N/m^2

(C) 22.6 MN/m^2 (D) 22.6 mN/m^2

68. Two linear block are connected in cascade without sampler. Determine the pulse response of the function of G1(s) = 1/s and G2(s) = 1/(S + 2)

(A) ½ Z/ [(z – 1)(z – e^{-2T})] (B) ½ Z (Z – e^{-2T}) / [(z – 1)(z – e^{-2T})]

(C) ½ Z/ [(z – 1)(z – 2)] (D) None of the above

69. Lyapunov's method can be used to develop optimal control law. The matrix P is solved for equation $A^TP + PA = -Q$ optimal values of performance index J is

(A) $-X^T(\infty)PX(\infty) + X^T(0)\,PX(0)$ (B) X^TPX

(C) $-X^T(\infty)PX(0) + X^T(0)\,PX(\infty)$ (D) $-X^TPX + X^T\,PX(0)$

70. Final value of f(kT) i.e., limit f(kt) as K->∞ can be obtained by

(A) Lt F(Z) as z→1 (B) Lt (z-1)F(Z)/Z as z→1

(C) Lt (Z-1)F(Z)/Z as z→1 (D) None of the above

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71. What is cardiac output when 10mg of indicator was injected and average concentration as calculated for curve was 5mg/lt for 20S ?

(A) 61/m (B) 4.51/m

(C) 41/m (D) 51/m

72. In a spectrophotometer the monochromator must be able to resolve two wavelength of 499.9 nm and 500.1 nm required resolution is

(A) 1000 (B) 2000

(C) 3000 (D) 100

73. What is the pulse separation in mode locked Nd:YAG laser when fluorescent line width is 1.1×10^{11}Hz and laser rod is 0.1m long ?

(A) 0.5nS (B) 0.6nS

(C) 0.7nS (D) 0.8nS

74. Fourier series coefficient of time domain signal $x(t)=j\partial(k-1)-j\partial(k+1)+\partial(k+3)+\partial(k-3)$ at $w=2P$ then corresponding time domain signal will be

(A) $2(\cos 6\Pi t-\sin \Pi t)$ (B) $-2(\cos 6\Pi t-\sin \Pi t)$
(C) $2(\cos 6\Pi t-\sin 2\Pi t)$ (D) $-2(\cos 6\Pi t-\sin \Pi t)$

75. Find FFT of [1 1 1 1]

(A) [2 0 0 0] (B) [2j – 2j 2j – 2j]

(C) [4 0 0 0] (D) [4 1 1 1]

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